

Handbook on Natural Dye Extraction and Dyeing Methods

Content

1. Introduction

- Overview of the project “*Mapping Nature’s Palette for Climate-Responsive Artisanal Practices*”
- Objectives of the handbook
- Importance of natural dyeing in climate-responsive craft practices

2. Understanding Natural Dyes

- Historical background of natural dyeing in India
- Transition from natural to synthetic dyes
- Environmental impacts of synthetic dyes
- Revival and relevance of sustainable dyeing today

3. Plants and Natural Sources for Dyes

- Classification with Plant identification guide (photos): native and invasive dye-yielding plants in the Garhwal Himalayas and other regions
- Parts used for dyeing (roots, leaves, bark, flowers, etc.)
- Harvesting guidelines and sustainable collection methods
- Other Natural Sources of Colour: Animal and Mineral Origins

4. Sustainable Dye Extraction and Application Techniques

- Step-by-step methods for extraction
- Preparation of fibres and fabrics (scouring, mordanting, etc.)
- Dyeing processes (boiling, fermentation, solar dyeing, etc.)
- Waste management and water reuse techniques
- Tips for consistency, colourfastness, and eco-safety

5. Case Studies and Success Stories

- Artisans and enterprises commercially dealing in Natural Dyes or Natural Dyed products
- Good practices followed by Natural Dye manufacturers and consumers across India (e.g. Rajasthan, Bihar, Gujarat)
- Economic, environmental, and social impacts achieved.

6. Innovations and Climate-Responsive Practices

- New techniques integrating traditional and modern methods
- Use of invasive species such as Lantana Camara for environment benefit.

7. Workshop Learnings and Field Experiences

- Highlights from field visits and training sessions
- Insights from trainers, researchers, and participants
- Common challenges and solutions observed

8. Practical Toolkit

- Checklist for artisans (tools, materials, safety)
- Dye recipes for different classification of dyes – Protein and Cellulosic
- Templates for recordkeeping and process documentation

9. Digital and Multimedia Integration

- QR codes or links to short video demonstrations and reels
- References to online repository / YouTube channel

References and Resources

- Bibliography and research sources
- List of contributing organizations, experts, and artisans
- Useful links for further reading and training

“Mapping Nature’s Palette for Climate-Responsive Artisanal Practices”

Chapter 1

Introduction

1.1 Project Overview

“Mapping Nature’s Palette for Climate-Responsive Artisanal Practices” is a British Council–supported initiative that explores how **native and invasive plant species** in the Garhwal Himalayas can be used to produce **sustainable natural dyes**. The project works closely with local artisan communities to revive indigenous dyeing knowledge, strengthen eco-friendly craft practices, and connect cultural heritage with climate-responsive innovation.

Natural dyeing has long been an integral part of Indian art and craft traditions. However, over the years, **synthetic dyes replaced natural colours**, resulting in a decline of ecological knowledge, increased environmental pollution, and reduced cultural continuity. With the global movement toward sustainable and environmentally responsible production, natural dyeing is regaining relevance—in terms of eco-friendliness, sustainability and revival of the traditional art.

The project responds to this need by developing **training materials, manuals, videos, and guides** that document:

- **Sustainable harvesting**
- **Extraction process and Dyeing techniques for natural dyes**
- **Case studies or Success stories** of those who have adapted natural dyes and have commercially used them thereby creating an example of success.
- **Good practices from other artisan clusters**, and
- **Multimedia resources** that widen its reach and impact.

Overall, the project strengthens local livelihoods, preserves traditional ecological knowledge, and supports artisans, students, designers, and communities to adopt *climate-friendly dyeing techniques*.

1.2 Objectives of the Handbook

1. To consolidate sustainable natural dyeing knowledge into one user-friendly resource

The handbook aims to bring together step-by-step dyeing processes, list of potential dye yielding raw materials, extraction methods, and eco-friendly application practices that artisans, and students can easily understand and apply.

2.To document and preserve indigenous and local knowledge

The handbook aims to document and preserve the rich reservoir of indigenous knowledge associated with natural colours—knowledge that has existed across India since ancient times and has been integral to traditional arts, paintings, textiles, and craft practices. For centuries, artisans have used plant-based colours for multiple art forms, yet much of the practical methodology of dye extraction, preparation, and application is now fragmented or at risk of being forgotten. By systematically recording these processes, and techniques, the handbook provides artisans, dyers, students and learners with reliable and accessible guidance. This documentation empowers users to adopt more eco-friendly, sustainable dyeing practices, ensuring that traditional colour-making skills remain relevant and beneficial in today’s climate-responsive craft ecosystems.

3.To showcase case studies, success stories, and good practices from the field

These real-life stories serve to:

- inspire artisans,
- demonstrate replicable models, and
- highlight climate-responsive innovations.

4. To support climate-friendly and sustainable craft livelihoods

The handbook’s content is designed to promote:

- environmentally responsible dyeing,
- use of local and invasive plants,
- low-waste and low-energy methods, and
- economically viable natural-dye enterprises.

5. To serve as a practical training and teaching tool

It will integrate:

- illustrated guides,
- process steps,
- troubleshooting advice,
- workshop learnings,
- and QR-linked multimedia resources.

This makes it usable for:

- artisan trainings,
- design schools,
- NGOs,
- and craft capacity-building programs.

6. To complement the digital repository and multimedia outputs

The handbook will link with short videos, reels, and photo guides hosted on an open-access online repository (e.g., a dedicated webpage or YouTube channel). This strengthens knowledge dissemination and ensures accessibility for diverse craft communities.

7. To make sustainable and culturally rooted dyeing methods replicable across India

By standardising knowledge and sharing replicable models, the handbook supports bigger goals of:

- scaling eco-conscious dyeing practices,
- influencing the next generation of artisans,
- and contributing to climate-responsive craft ecosystems.

1.3 Importance of Natural Dyeing in Climate-Responsive Craft Practices

Natural dyeing plays a vital role in climate-responsive craft practices because it restores a regenerative relationship between artisans, ecosystems, and cultural heritage. Unlike synthetic dyes—which rely on petrochemicals, intensive water use, and pollutant-heavy effluents—natural dyes are derived from renewable plant sources such as leaves, roots, barks, flowers, and even invasive species (eg Lantana Camara) that threaten forest biodiversity. These natural resources support *closed-loop, low-impact production systems* that reduce carbon footprint and water pollution while enhancing soil and ecological health.

By reintroducing natural dyeing into contemporary craft ecosystems, artisans can build climate-smart enterprises rooted in local materials, ethical consumption, and circular use of resources. This shift also opens pathways for plant-based innovation, diversified income streams, and cultural continuity, enabling craftspeople to adapt to changing climate conditions while preserving their artistic identity. In this way, natural dyeing becomes a bridge between heritage and sustainability—a practice that honors the past while empowering communities to create a greener, more resilient craft future.

Chapter 2

Understanding Natural Dyeing

Natural dyeing is one of the oldest colour traditions in human history, deeply interwoven with India's cultural, ecological, and artisanal heritage. Across generations, artisans have relied on locally available plants, minerals, and natural materials to create rich, enduring colours. To understand the significance of sustainable dyeing today, it is important to trace natural dyeing's historical roots, the shift toward synthetic dyes, and the emerging global recognition of natural colours as climate-responsible alternatives.

2.1 Historical Background of Natural Dyeing in India

India has been a global centre of natural dyeing for thousands of years. Ancient texts such as the *Atharva Veda* and *Charaka Samhita* reference the use of natural colours for textiles, rituals, and medicinal applications. Regions like Gujarat, Rajasthan, Andhra Pradesh, Bengal, and the Himalayan belt became renowned for their mastery over colours derived from plants such as madder (manjishtha), turmeric, indigo (nila), pomegranate rind, marigold, and the bark of various trees. Please have a look at following data:

- Archaeological evidence suggests that **textile dyeing with natural colorants dates back over 5,000 years**.
- Madder-dyed cloth was found at **Mohenjo-Daro**, indicating the use of madder plant dyes in the Indus Valley around **3000 BC**.
- Dyes from plants, animals, and minerals were the **only sources of colourants in textile and art production** until the mid-19th century when synthetic dyes emerged.
- In India, **more than 450 plant species** are known to yield dye colours, many of which also have medicinal properties.
- Historical documentation of Indian dyeing traditions includes **Thomas Wardle's 1875 compilation** of over 3,000 dyed fabrics from **64 plant sources** reflecting Indian natural dye practices.

Indian dyers developed sophisticated techniques for mordanting, resist dyeing, block printing, and patterning—many of which were admired globally. The famed **Indigo of India** became a highly valued export, shaping trade routes from the Indian subcontinent to Egypt, Greece, and later Europe. Natural dyeing was not just a craft but a knowledge system that integrated agriculture, ecology, and community identity.

2.2 Transition from Natural to Synthetic Dyes

The introduction of synthetic dyes in the mid-19th century marked a turning point. Synthetic dyes quickly became popular due to their lower cost, ease of production, and ability to create a wide spectrum of uniform shades. The industrial revolution accelerated their global adoption, and artisan-led natural dyeing practices began to decline.

In India, colonial-era policies and industrial mills further weakened traditional dyeing ecosystems. Synthetic dyes promised faster, cheaper, and more predictable results, leading many artisans to replace natural colours. Over time, this shift resulted in the erosion of indigenous knowledge, reduction in the cultivation of dye-yielding plants, and a growing disconnect between craft traditions and ecological systems.

2.3 Environmental Impacts of Synthetic Dyes

While synthetic dyes offered convenience and scalability, they brought significant environmental challenges:

- **Water Pollution:** Synthetic dye effluents contain chemicals, heavy metals, and non-biodegradable substances that pollute rivers and groundwater.
- **Toxic Byproducts:** Chemical dye manufacturing often produces hazardous waste, posing risks to ecosystems and human health.
- **High Resource Use:** Many synthetic dyes require chemical fixatives, large quantities of freshwater, and energy-intensive processes.
- **Microplastic Contamination:** Synthetic colours used on synthetic fibres contribute to microplastic shedding and long-term pollution.

2.4 Revival and Relevance of Sustainable Dyeing Today

With increasing global awareness of climate change, ecological degradation, and ethical production, natural dyeing is experiencing a strong and meaningful revival. Designers, researchers, and artisan communities are returning to plant-based dyes for their:

- **Low environmental footprint**
- **Biodegradability and non-toxicity**
- **Connection to local biodiversity**
- **Cultural authenticity and heritage value**

Today, natural dyeing is part of a broader movement towards **climate-responsive craft practices** that prioritize circularity, regenerative resource use, and community-led innovation. In regions like the Garhwal Himalayas, the use of dye-yielding plants, including invasive species, provides artisans with sustainable livelihoods while supporting ecological balance.

This revival is not merely nostalgic—it aligns with global sustainability goals (SDGs), ethical fashion movements, and community-based resilience strategies. As more artisans, educators, and consumers embrace natural colours, the practice stands poised to shape a greener, culturally rooted future for Indian crafts.

Chapter 3

Plants and Natural Sources for Dyes

Plants have been the primary source of natural colour across India for thousands of years, forming the foundation of traditional dyeing practices in textiles, paintings, and crafts. Each region of India has some special plants used for extraction of colours. It could be from different parts of the plants such as flowers, leaves, roots, bark, fruits, and even invasive shrubs have long been used to create vibrant and earthy hues. In the Garhwal Himalayas, this relationship with natural colours is deeply embedded in cultural heritage and everyday craft activities. Understanding the wide variety of dye-yielding plants, their ecological roles, and their colour potential is essential for artisans, designers, and students seeking to adopt sustainable, climate-responsive dyeing methods.

3.1 Classification: Native and Invasive Dye-Yielding Plants in the Garhwal Himalayas

India's diverse ecological landscapes—from the Himalayan foothills to the plains, forests, and coastal regions—are home to hundreds of dye-yielding plants. For generations, artisans have relied on these natural sources to extract vibrant colours for textiles, paintings, and craftwork. In the context of the Garhwal Himalayas, where this project is anchored, dye sources belong broadly to two categories: **native species** that are integral to the region's ecology and culture, and **invasive species** that, despite their negative environmental impact, offer valuable opportunities for sustainable dye extraction

3.1.1 Native Dye-Yielding Plants of the Garhwal Himalayas with Plant identification guide (photos)

Native plants have evolved naturally in the Himalayan ecosystem and form an essential part of its biodiversity. Many of these species have long been used by local communities for colouring wool, cotton, bamboo, and traditional handicrafts.

Key Characteristics of Native Plants

- Adapted to local climate and soil
- Sustain ecological balance
- Traditionally used in indigenous dyeing practices
- Provide stable and reliable colour outputs

Examples of Native Dye Plants

1. Walnut (*Juglans regia*)



Produces deep browns and warm earthy tones from the **husk and bark**. Widely used in wool dyeing in the mountains.

2. Himalayan Rhododendron (*Rhododendron arboreum*)



Its bright red flowers yield subtle pinks and peach tones. Known locally as *Buransh*.

3. Indian Madder / Manjishtha (*Rubia cordifolia*)



A historic dye plant producing shades of red, brick, and brown from its roots.

4. Pomegranate (*Punica granatum*)



The rind produces soft yellows and khaki greens when combined with iron.

5. Turmeric (*Curcuma longa*)



A staple in many Indian households, yielding bright golden yellows.

These plants not only offer colour but also hold cultural significance, connecting dyeing traditions to seasonal cycles, forest knowledge, and regional craft identities.

3.1.2 Invasive Dye-Yielding Plants with Plant identification guide (photos): A Sustainable Opportunity

Invasive species are non-native plants that spread rapidly and disrupt local ecosystems. In the Himalayan region, these plants often outcompete native species, alter soil composition, and threaten biodiversity. However, many of them contain colour pigments that can be harnessed for natural dyes—turning an ecological challenge into a climate-positive solution.

Why Use Invasive Plants for Dyeing?

- Reduces pressure on native species
- Encourages ecological restoration
- Provides free and abundant dye resources
- Supports circular economy principles

Examples of Invasive Dye Plants

1. *Lantana camara*



A fast-spreading shrub whose leaves and stems produce soft yellows, greens, and browns. Its management through harvesting supports forest health.

2. *Parthenium hysterophorus* (Congress Grass)



Though highly invasive and allergenic, controlled use of its biomass yields pale yellows and beige tones.

3. Eupatorium / Crofton Weed (*Ageratina adenophora*)



Produces muted yellows and earthy tones. Harvesting helps reduce its adverse impact on forest vegetation.

4. Eucalyptus Species (Non-native in many regions)



The bark and leaves offer warm browns and golden hues. Its abundant litter can be used without harming the tree.

Using invasive plants as dye sources aligns with climate-responsive craft practices by enabling artisans to create value from abundant, under-utilised resources while contributing to ecological restoration.

5. *Ageratum conyzoides* (Gandhali Ghaas)



A herbaceous plant with soft, hairy leaves and clusters of small blue or purple flowers, commonly invading disturbed areas.

Dye Potential: Flowers yield blue and purple pigments, offering an alternative to synthetic indigo dyes.

3.1.3 Dye Plants from Other Regions of India with Photo Identification Guide (photos)

While the Garhwal Himalayas are central to this project, several dye-yielding plants from other Indian regions complement the knowledge repository. These species enrich the colour palette and broaden applicability for artisans across the country.

Examples

1. Indigo (*Indigofera tinctoria*) — South & West India



Known for its iconic deep blue, indigo remains one of India's most celebrated dye plants.

2. Marigold (*Tagetes erecta*) — North & Central India



The flowers produce bright yellows and orange shades widely used in textile dyeing.

3. Myrobalan / Harad (*Terminalia chebula*) — Central and South India



A powerful natural mordant and dye producing yellow and olive tones.

4. Catechu (*Acacia catechu*) — Rajasthan & Guja



Yields rich browns and reddish-brown tones used in block printing.

5. Henna (*Lawsonia inermis*) — Rajasthan & Haryana



Provides orange, rust, and soft brown shades.

These plants demonstrate India's vast natural colour heritage and support the creation of a comprehensive, cross-regional dyeing handbook.

3.2. Parts Used for Dyeing (Roots, Leaves, Bark, Flowers, etc.)

Natural dyes are obtained from a wide variety of plant parts, each offering unique colours, shades, and properties. Understanding which parts of a plant yield pigment—and how they behave during extraction—is essential for achieving consistent and sustainable dye results. Different colours may come from different parts of the same plant, and artisans traditionally selected plant material based on season, maturity, and desired shade. Below are the major plant components used in natural dyeing.

How Plant Parts Influence Colour

Each plant part contains different pigments:

| Plant Part | Pigments Commonly Found | Sample Shades |
|-------------|-----------------------------|---------------------------------|
| Roots | Antraquinones, Curcuminoids | Red, brown, yellow |
| Leaves | Chlorophyll, Flavonoids | Green, yellow, brown |
| Flowers | Carotenoids, Anthocyanins | Yellow, orange, pink |
| Bark | Tannins | Brown, olive, black (with iron) |
| Fruits/Rind | Tannins, Organic acids | Yellow, grey, olive |
| | | |

3.2.1 Roots

Roots often contain strong, concentrated pigments that produce deep and long-lasting colours.

Examples:

- **Indian Madder (Manjishtha / Rubia cordifolia):** Red, brick, and brown shades
- **Turmeric root (Curcuma longa):** Bright yellow
- **Onion root residues:** Pale yellow and beige tones

Characteristics:

- High dye concentration
- Requires careful, sustainable harvesting
- Often used in powdered or chopped form

3.2.2 Bark

Bark is one of the richest sources of tannins—natural compounds that help fix dyes to fibres, improving colourfastness.

Examples:

- **Walnut bark (Juglans regia):** Dark brown
- **Acacia catechu (Khair):** Reddish brown
- **Pomegranate bark:** Warm yellow and olive tones

Characteristics:

- Excellent for wool, cotton, and silk
- Often boiled for long periods to release tannins
- Can be used fresh or dried

3.2.3 Leaves

Leaves provide a range of green, yellow, and brown tones depending on the plant species and extraction method.

Examples:

- **Henna (Lawsonia inermis):** Orange-brown
- **Eucalyptus leaves:** Golden brown
- **Guava leaves:** Subtle pinks and browns
- **Lantana leaves (invasive):** Light yellow to green

Characteristics:

- Easy to collect sustainably
- Best used fresh for stronger colour
- Often require mordants for deeper shades

3.2.4 Flowers

Flowers are widely used for vibrant yellows, oranges, and pinks, and are among the most accessible dye sources for artisans.

Examples:

- **Marigold (*Tagetes erecta*):** Bright yellow and orange
- **Himalayan Rhododendron (*Buransh*):** Rose pink and peach
- **Hibiscus:** Deep pink and purple shades

Characteristics:

- Produce vivid but sometimes less colourfast dyes
- Great for seasonal, community-based dyeing
- Can be solar-dyed to enhance fragrance and colour

3.2.5 Fruits and Rinds

Many fruits contain tannins, acids, or natural pigments that serve as dyes or mordants.

Examples:

- **Pomegranate rind:** Yellow, olive, grey (with iron)
- **Myrobalan / Harad (*Terminalia chebula*):** Classic yellow mordant dye
- **Amla (Indian gooseberry):** Tannin-rich, used as a mordant

Characteristics:

- Long-lasting colours
- Widely used in both textile dyeing and Ayurveda
- Often dried and stored for year-round use

3.2.6 Seeds

Some seeds produce oils or pigments used for specialist dyes.

Examples:

- **Annatto seeds:** Orange and reddish hues
- **Tesu/Butea seeds:** Rarely used directly, but flowers are common

Characteristics:

- Provide rich tones when ground or soaked
- Require careful preparation

3.2.7 Branches and Twigs

Certain woody parts offer muted shades that are ideal for earthy colour palettes.

Examples:

- **Lantana twigs:** Light brown
- **Eupatorium stems:** Pale yellow

Characteristics:

- Useful in large-quantity dye vats
- Often an eco-friendly use of pruning waste

3.2.8 Whole Plant/Weeds

In the case of invasive or fast-growing species, the **entire plant** is used to maximise dye extraction while supporting ecological management.

Examples:

- **Parthenium (Congress grass):** Beige, pale yellow
- **Eupatorium adenophorum:** Soft yellows
- **Wild Himalayan weeds:** Mixed earth tones

Characteristics:

- Ideal for zero-waste dyeing
- Allows sustainable removal of harmful species

3.3. Harvesting Guidelines and Sustainable Collection Methods

Sustainable natural dyeing begins with responsible harvesting. The way roots, leaves, flowers, bark, and whole plants are collected directly affects the health of local ecosystems and the long-term availability of dye-yielding species. In regions like the Garhwal Himalayas—where biodiversity is both rich and fragile—ethical harvesting is essential to maintaining ecological balance while supporting community livelihoods. The guidelines below help users gather plant material in a way that protects species, respects forest cycles, and aligns with climate-responsive craft practices.

3.3.1 General Principles of Sustainable Harvesting

Harvest in moderation

Never collect more than **20–30%** of the plant material available in one location. This ensures the plant population can naturally regenerate.

Follow seasonal cycles

Collect plant parts during their natural abundance:

- Flowers in peak bloom
- Leaves in healthy, mature stages
- Roots only after the plant has propagated
- Bark from fallen branches, not live trunks

Avoid overharvesting from a single plant

Rotate locations and plants to prevent depletion. A healthy plant community is key to consistent colour availability.

Use clean, non-destructive tools

Sharp knives or pruning shears prevent unnecessary damage. Avoid uprooting entire plants unless specifically recommended (e.g., certain invasive weeds).

3.3.2 Sustainable Harvesting by Plant Part

Leaves

- Harvest only mature leaves; young leaves weaken the plant.
- Pick a few leaves from each branch rather than stripping a single stem.
- Avoid collecting during rainy or fungal seasons.

Flowers

- Collect in early morning for maximum pigment.
- Take fallen or slightly wilted flowers when possible.
- Never pluck all flowers from a single plant—leave some for pollinators and seed formation.

Bark

- Prefer bark from naturally fallen branches.
- If collecting from a living tree, remove only small strips from pruned limbs, not the main trunk.
- Never ring-bark a tree; it will kill the plant.

Roots

- Harvest roots sparingly and only from mature plants with sufficient propagation.
- When possible, collect during replanting or weeding cycles.
- For highly valued root dyes like *Manjishtha*, source from cultivated or managed farms.

Fruits and Rinds

- Use by-products (e.g., pomegranate rinds, amla skins) from household or market waste.
- Sundry and store to reduce dependence on fresh harvesting.

Twigs and Branches

- Use pruned branches, storm fall, or seasonal shedding.
- Prioritize dry wood, which requires less processing.

3.3.3 Harvesting Invasive Species Responsibly

Invasive plants such as **Lantana camara**, **Eupatorium adenophorum**, and **Parthenium** threaten Himalayan ecosystems but also provide valuable dye material. Their sustainable harvesting supports both craft and conservation.

Guidelines

- Uproot invasives fully wherever safe and feasible.
- Collect before flowering or seeding to prevent further spread.
- Avoid transporting seed-bearing parts to new areas.
- Compost or solar-dry leftover biomass to neutralize regrowth.

This approach turns ecological challenges into dyeing opportunities while aiding forest restoration.

3.3.4 Safe Collection Practices for Artisans

- Wear gloves when handling irritant or allergenic plants (e.g., Parthenium).
- Use baskets or cloth bags instead of plastic to prevent sweating or fungal growth.
- Label collected material immediately for accuracy during dye extraction.
- Store materials in dry, shaded areas to preserve pigment strength.

3.3.5 Community-Based and Ethical Practices

Sustainable harvesting is most effective when practiced collectively:

- **Coordinate with forest communities** to respect local regulations.
- **Promote cultivation** of high-demand species like marigold, turmeric, and manjishtha to reduce pressure on wild stocks.
- **Organize seasonal collection drives** for invasive plants to support ecological health.
- **Share knowledge** among artisans, students, and dyers to build responsible habits.

3.3.6 Zero-Waste Use of Plant Materials

To reduce environmental impact:

- Use excess biomass for composting or paper-making.
- Reuse dye bath water for multiple rounds or for fabric pre-soaking.
- Dry and store leftover plant material for future use.
- Integrate stems, leaves, and seeds into other craft forms (e.g., printing, handmade paper, natural inks).

Responsible harvesting ensures that dye-yielding plants—both native and invasive—are used in ways that protect biodiversity, respect nature’s rhythms, and support sustainable livelihoods. When artisans adopt these practices, natural dyeing becomes not only a craft technique but a tool for climate resilience and ecological stewardship.

3.4 Other Natural Sources of Colour: Animal and Mineral Origins

While many natural dyes and pigments are derived from plant sources, traditional colour systems across India and the world also include **animal-derived** and **mineral-derived** materials. These sources have been integral to artistic, textile, and cultural practices for centuries and contribute unique hues, textures, and cultural value that plant dyes alone cannot provide.

3.4.1 Animal-Derived Colours: Lac Dye

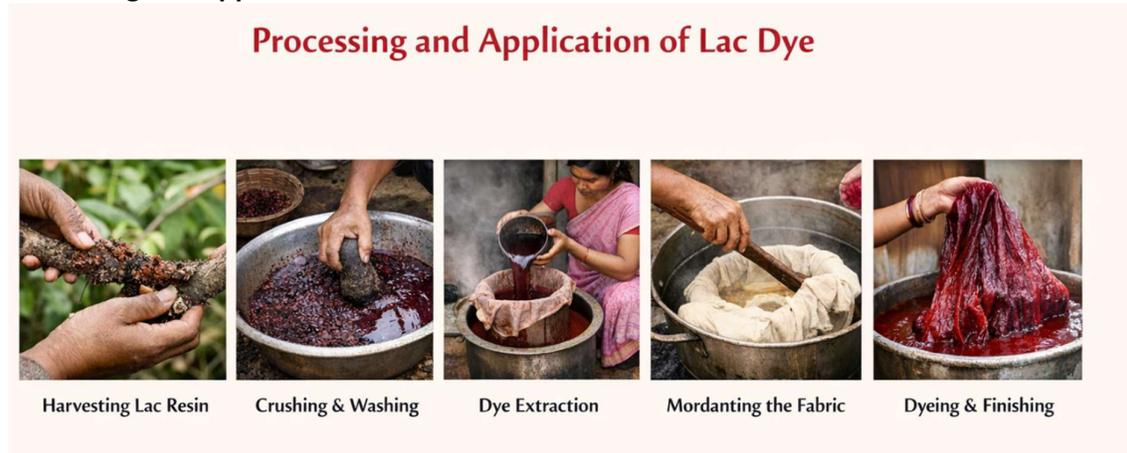
What Is Lac Dye?

Lac dye is a **natural red colourant obtained from the secretions of the lac insect (*Kerria lacca*)**, which lives primarily on host trees such as palas (*Butea monosperma*), ber (*Ziziphus mauritiana*), and kusum (*Schleichera oleosa*). The resinous shellac produced by these insects contains a rich red pigment that can be extracted and used as a dye.

Traditional Use of Lac Dye

- **Textile dyeing:** Lac has been widely used as a red dye for silk and cotton textiles, especially in traditional crafts like bandhani (tie-dye), block printing, and embroidery threads.
- **Arts and ornamentation:** Lac pigments are also used in miniature paintings and decorative art traditions.
- **Cosmetics and lacquer work:** The resin has historic use in cosmetics, varnishes, and lacquer ware.

Processing and Application



1. **Harvesting lac resin (sticklac):** Collected from branches where lac insects thrive.
2. **Crushing and washing:** Resin is crushed and repeatedly washed to remove impurities and separate dye components.
3. **Extraction:** The cleaned lac is dissolved in hot water or alkaline solutions to release red pigments.
4. **Mordanting:** Fabrics are pre-treated with natural mordants (e.g., alum or tannins) to fix the lac colour.
5. **Dyeing:** Dye baths are prepared and textiles are dyed to achieve warm red and burgundy shades.

Colour Characteristics

- Warm **reds**, **brick**, and **burgundy** hues
- Soft tonal quality with good affinity for natural fibres
- Traditional and culturally significant in many South Asian crafts

3.4.2 Mineral-Derived Colours: Pigments from Stone and Earth

Mineral sources have been used for millennia across painting, sculpture, and textiles. These **earth pigments** and **stone-derived colours** are obtained from naturally occurring minerals and rocks, and often produce hues that are *distinctly rich and enduring*.

Common Mineral Colour Sources



| Mineral Source | Colour Produced | Typical Uses |
|------------------------------------|-----------------------|--|
| Ochre (Yellow / Red Earths) | Yellows, reds, browns | Wall paintings, textile prints, pigments |
| Lapis Lazuli | Deep ultramarine blue | Miniature paintings, fine art pigments |
| Malachite | Green shades | Decorative art, traditional paintings |
| Rasod / Red Earths | Ochre-yellow, red | Pigments in folk art |
| Mica | Silver/gold shimmer | Embellishments in paintings and crafts |

Traditional Processing of Mineral Colours

1. **Collection of mineral stones or earths** from natural deposits
2. **Cleaning and crushing** into coarse pieces
3. **Grinding** into very fine powder using stone or mechanical grinders
4. **Washing and settling** to remove non-pigment particles
5. **Mixing with binders** (e.g., natural gum, plant gum, egg white, or oil) for adhesion in painting

Mineral colours are **stable over time**, often showing excellent *lightfastness* and *longevity*, which makes them valued for fine art and heritage painting practices.

3.4.3 Comparing Plant, Animal, and Mineral Sources

| Source Type | Examples | Typical Colours | Special Characteristics |
|----------------|--------------------------|--------------------------------|--|
| Plant | Indigo, madder, turmeric | Blues, reds, yellows | Renewable, season-linked, varied by part used |
| Animal | Lac dye | Deep red | Culturally rooted, insect-derived, distinct reds |
| Mineral | Ochre, lapis, malachite | Earthy tones, deep blue, green | Long-lasting, art-grade pigments |

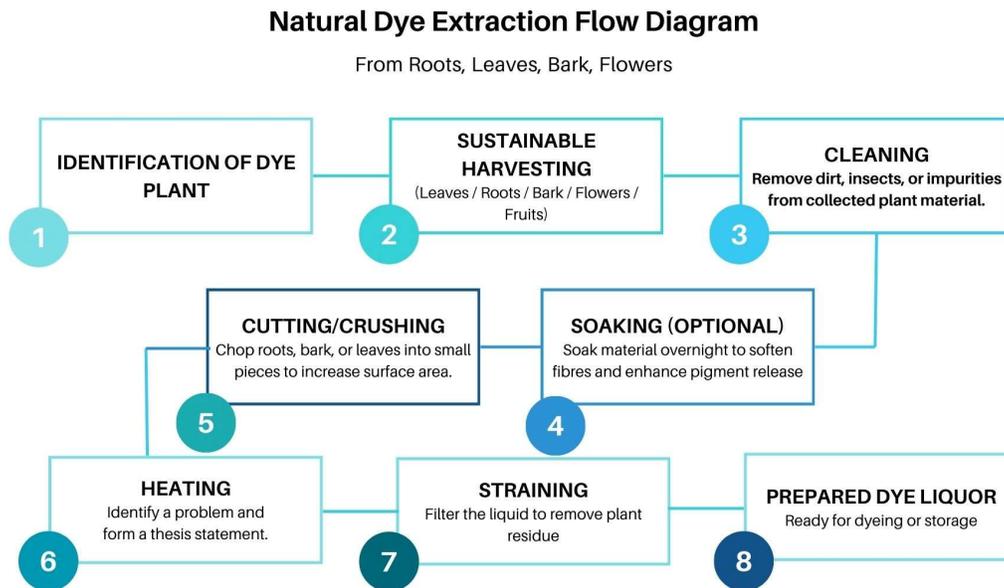
Chapter 4.

Sustainable Dye Extraction and Application Techniques

4.1 Step-by-Step Methods for Dye Extraction

Dye extraction is the process of releasing colour pigments from plant materials into a liquid medium, usually water. The method varies depending on the plant part used.

General Extraction Process



Extraction Tips

- Avoid aluminium vessels; use stainless steel, copper, or earthen pots.
- Low and slow heating preserves pigment quality.
- Multiple extractions can be done from the same plant material.

4.2 Preparation of Fibres and Fabrics

Proper preparation ensures even dye absorption and colour durability. The process of preparation involves a) scouring b) mordanting

4.2.1 Scouring (Cleaning the Fabric)

Scouring removes natural oils, waxes, and sizing agents.

For Cotton and Linen:

- Boil fabric in water with natural soap or soda ash.
- Rinse thoroughly.

For Silk and Wool:

- Wash gently in lukewarm water with mild soap (neutral soap such as Ezee).
- Avoid agitation and high heat.



Before Scouring



After Scouring

4.2.2 Mordanting

Mordants help dyes bind to fibres and influence colour shades.

Common Natural Mordants

| Mordant | Source | Effect |
|----------------|---------------------|----------------------------|
| Alum | Mineral | Brightens colours |
| Iron | Rusted iron + water | Darkens shades |
| Copper | Copper vessel | Greens and olives |
| Myrobalan | Plant-based | Acts as both dye & mordant |

Mordanting Process:

1. Dissolve mordant in warm water.
2. Soak pre-wetted fabric for 30–60 minutes.
3. Rinse lightly before dyeing.

4.3 Dyeing Processes

Different dyeing methods produce varied textures, shades, and sustainability outcomes.

4.3.1 Boiling Method

Step 1: Preparing the Dye Liquor

1. Take the dye raw material (roots, leaves, bark, flowers, or fruit rinds).
The material can be used:
 - in its raw or chopped form, or
 - in a crushed or powdered form for quicker colour release.
2. Add the plant material to a pot of clean water.
A general ratio is 1 part plant material to 2–3 parts water.
3. Heat the mixture slowly and allow it to boil gently for about 45–90 minutes, depending on the plant type.
4. As the mixture boils, the natural pigments dissolve into the water, forming a dye liquor.
5. Once a strong colour is obtained, strain the liquid to remove plant residues.
The filtered liquid is now ready for dyeing.



Boiling dye material



Strained dye liquor

Step 2: Adding the Mordanted Fabric

1. Take the **pre-scoured and mordanted fabric** and thoroughly wet it with clean water.
Wet fabric absorbs dye more evenly.
2. Gently place the fabric into the prepared dye bath.

3. Heat the dye bath again on **low to medium heat** for **30–60 minutes**, stirring occasionally to ensure even colour penetration.
4. Avoid vigorous boiling once the fabric is inside the dye bath, especially for silk and wool.

Step 3: Cooling and Rinsing

1. After dyeing, allow the fabric to **cool naturally in the dye bath**. This helps deepen the colour.
2. Remove the fabric and rinse in cool water until excess dye is removed.
3. Dry the fabric in the **shade**, away from direct sunlight.

Important Tips for Beginners

- Always **extract colour first**, then add fabric.
- Never add dry fabric directly into boiling dye liquor.
- Gentle heat produces better colour and protects fibres.
- Keep notes of time, ratios, and results for consistency.

4.3.2 Fermentation Dyeing

Fermentation dyeing is a traditional natural dyeing technique used primarily for dyes such as **indigo** and certain plant-based colour sources that require an alkaline and oxygen-controlled environment. Unlike boiling methods, fermentation dyeing relies on **microbial activity** to release and fix colour onto fibres. This process may take longer but produces rich, long-lasting shades and is highly sustainable when done correctly.

Key Points:

Step 1: Preparation of the Dye Material

1. Take the dye material suitable for fermentation (commonly **indigo leaves or indigo cake**, and in some cases flower-based dyes).
2. If using fresh leaves, wash them thoroughly to remove dirt and impurities.
3. Crush or soak the material to help release colour compounds.



Indigo leaves



Indigo cake

Step 2: Creating the Fermentation Vat

1. Place the dye material in a non-reactive container (earthen pot, plastic drum, or stainless steel vessel).
2. Add clean water to fully submerge the material.
3. Introduce an alkaline agent such as:
 - Lime (calcium hydroxide)
 - Wood ash water
 - Soda ash (used carefully)
4. Add a natural reducing agent (optional but helpful), such as:
 - Jaggery
 - Rice water
 - Sugar
 - Wheat bran

These ingredients help activate fermentation by encouraging beneficial microorganisms.



Indigo vat

Step 3: Fermentation and Vat Activation

1. Stir the vat gently once or twice daily.
2. Keep the vat covered but not airtight.
3. Maintain a warm environment (25–35°C) for fermentation.
4. Over several days, the liquid changes colour (yellow-green surface, blue sediment).
5. A thin film or bubbles may appear—this indicates active fermentation.

Fermentation time:

- Fresh leaves: 2–5 days
- Indigo cake: 1–2 days

Step 4: Preparing the Fabric

1. Use **pre-scoured and mordanted fabric**.
2. Wet the fabric thoroughly before dyeing.
3. Gently squeeze out excess water.

(Important: Fabric must be wet to absorb fermented dye evenly.)

Step 5: Dyeing the Fabric

1. Slowly immerse the fabric into the fermented dye vat.
2. Avoid splashing or introducing excess air.
3. Gently move the fabric under the surface for 2–5 minutes.
4. Remove the fabric carefully and squeeze lightly.

At this stage, the fabric appears yellowish-green.

Step 6: Oxidation (Colour Development)

1. Expose the dyed fabric to air.
2. Watch the colour change from green to blue as oxidation occurs.
3. Allow the fabric to oxidise fully for 10–15 minutes.

This transformation is one of the most distinctive features of fermentation dyeing.

Step 7: Re-Dipping for Deeper Shades

1. Repeat dipping and oxidation cycles to deepen colour.
2. Allow short rest periods between dips.
3. Avoid rushing the process—depth builds gradually.

Step 8: Final Rinsing and Drying

1. Rinse fabric gently in clean water.
2. Avoid harsh soaps immediately after dyeing.
3. Dry in shade, away from direct sunlight.

Important Tips for Fermentation Dyeing

- Do not boil the dye vat—heat kills fermentation.
- Avoid metal contamination (especially iron unless intentional).
- Maintain pH balance (alkaline but not harsh).
- Keep records of ingredients, temperature, and results.

Why Fermentation Dyeing is Climate-Responsive

- Uses low energy (no boiling)
- Requires minimal water change
- Produces highly durable colours
- Supports traditional ecological knowledge

Common Mistakes to Avoid

- Adding dry fabric directly into the vat
- Over-stirring, which introduces oxygen
- Using cold water during fermentation

- Disposing of active vats improperly

While boiling method and fermentation methods are most widely used methods in Natural Dyeing however there are other low cost, more eco-friendly methods which might take more processing time. Below are some such methods:

4.3.3 Solar Dyeing

A low-energy, eco-friendly method.

Steps:

- Place plant material, water, and fabric in glass jars.
- Seal and place under direct sunlight for 2–6 weeks.
- Ideal for flowers and leaves.

4.3.4 Cold Dyeing

Suitable for delicate fibres.

- Dye bath used without heating.
- Longer soaking time.
- Produces softer shades.

4.4 Waste Management and Water Reuse Techniques

Sustainable dyeing minimises waste and maximises reuse.

Water Reuse

- Reuse dye bath for lighter shades.
- Use rinse water for scouring or gardening.
- Neutralise acidic or alkaline water before disposal.

Plant Waste Management

- Compost leftover plant material.
- Use as mulch or natural paper pulp.
- Dry and store for future extractions.

Zero-Waste Practices

- Measure water and material accurately.
- Combine multiple dye sessions.
- Use biodegradable soaps and mordants.

4.5 Tips for Consistency, Colourfastness, and Eco-Safety

Consistency Tips

- Maintain consistent ratios of plant to fibre.
- Record recipes, temperatures, and timing.
- Use the same water source where possible.

Improving Colourfastness

- Proper scouring and mordanting.
- Allow dyed fabric to rest for 24–48 hours.
- Final rinse with mild vinegar or salt solution (as appropriate).

Eco-Safety Guidelines

- Avoid toxic chemical mordants.
- Wear gloves when handling irritant plants.
- Keep dye waste away from water bodies.
- Ensure safe storage of powders and liquids.

Sustainable dye extraction and application techniques form the backbone of climate-responsive craft practices. By following these methods, artisans can achieve rich, long-lasting colours while protecting ecosystems, conserving water, and supporting ethical production systems. This chapter encourages a balance between tradition, innovation, and environmental responsibility.

Chapter 5

Case Studies and Success Stories.....Natural Dyes can make you earn your living!

After understanding the theoretical details of natural dyes, their chemistry, their types and how to dye with them, now it is time to move from theory to practice by showcasing real-world examples of artisans, enterprises, and communities that have successfully integrated natural dyes into their livelihoods. Across different regions of India, traditional knowledge has been adapted to contemporary markets, proving that natural dyeing can be both environmentally responsible and economically viable. The case studies presented here highlight good practices followed by natural dye manufacturers and conscious consumers of natural dyes, illustrating how sustainable dyeing supports income generation, reduces environmental harm, and strengthens cultural identity. Together, these examples demonstrate the tangible economic, environmental, and social impacts of adopting natural dyes, offering inspiration and practical insights for artisans, designers, and policymakers alike.

Sodhani Biotech — Scaling Natural Dyes from Craft Roots to Global Industrial Markets

Background and Evolution of the Company

Sodhani Biotech is a Jaipur-based natural dye manufacturing company that represents a significant shift in how natural dyes are produced and positioned for contemporary textile markets. The company was established in 2014, initially producing natural dyes using traditional methods of crushing dye-yielding raw materials into powder form. During its early years, Sodhani Biotech catered primarily to small-scale users and craft-oriented dyeing practices, where powdered dyes were used in vessels for manual dyeing.



Mr Siddhant Sodhani, Managing Director, Sodhani Biotech

A major transformation occurred in 2017, when the company expanded its operations and invested in solvent-based extraction technology. This marked a turning point in its growth trajectory. By adopting scientific extraction methods, Sodhani Biotech was able to isolate natural colour pigments in a more refined, concentrated, and consistent form. This technological shift significantly enhanced the usability of natural dyes in industrial dyeing machines such as jiggers, cabinet dyeing machines, and other bulk dyeing systems—an area where conventional powdered dyes face limitations.

Innovation in Extraction and Dyeing Technology

Unlike traditional powdered dyes, which often contain coarse particles and plant residues unsuitable for machine dyeing, Sodhani Biotech's solvent-extracted natural dyes consist of very fine pigment particles. These pigments dissolve uniformly in water, allowing controlled and reproducible dyeing at scale.

This innovation enabled the company to bridge a critical gap between traditional natural dyeing and modern industrial textile processing. As a result, Sodhani Biotech expanded beyond artisanal markets and positioned itself as a supplier to professional dyeing units and international buyers seeking sustainable alternatives to synthetic dyes.

Products and Raw Materials

Sodhani Biotech manufactures a wide range of natural dye extracts derived from plant-based raw materials, including:

- Indigo (*Indigofera tinctoria*)
- Madder / Turkey Red (*Rubia cordifolia*)
- Myrobalan (*Terminalia chebula*)
- Pomegranate rind (*Punica granatum*)
- Gardenia-based pigments
- Onion peel and other botanical sources

The company also works with plant waste and by-products, strengthening its sustainability credentials and aligning with circular economy principles.

Market Reach and Commercial Success

Following the adoption of solvent-based extraction, Sodhani Biotech significantly expanded its global footprint. Today, the company supplies natural dye extracts to **natural dyeing companies and textile units in Turkey, Vietnam, Japan, and Sri Lanka**, positioning itself as a reliable international supplier of machine-compatible natural dyes.

In the **Indian market**, the company reports a **small but consistent demand**, largely from the craft and handloom sector. While the domestic market for industrial natural dyes is still emerging, Sodhani Biotech continues to serve Indian craft clusters, designers, and sustainable textile initiatives that value plant-based dyes despite their limitations.

This dual presence—global industrial supply and local craft engagement—highlights the company's balanced approach to sustainability and commerce.

Challenges in the Natural Dye Industry: Insights from the Manufacturer

According to **Mr. Siddhant Sodhani, Managing Director of Sodhani Biotech**, the natural dye industry faces two major structural challenges:

1. Colour Fastness, Especially Light Fastness

Light fastness remains one of the most persistent limitations of natural dyes. While improvements can be made through better mordanting, fibre selection, and application techniques, Mr. Sodhani notes that **light fastness is likely to remain a long-term challenge** for natural dyes when compared to synthetics. His company continues to research methods to enhance performance, but also believes that realistic expectations and informed usage are essential.

2. Limited Colour Spectrum

Another key challenge is achieving a **wider and more vibrant colour spectrum** from natural sources. While natural dyes excel in earthy, muted, and heritage shades, achieving bright and diverse colours comparable to synthetic dyes requires extensive research. Sodhani Biotech is actively engaged in R&D to expand the palette available from botanical sources, combining traditional knowledge with scientific innovation.

Good Practices and Industry Contribution

Sodhani Biotech demonstrates several good practices that make it a leading example in this sector:

- Investment in **research and scientific extraction** rather than relying solely on traditional processing
- Development of **machine-compatible natural dyes**, enabling bulk dyeing
- Transparent acknowledgment of limitations in natural dyes rather than overstating claims
- Continued engagement with craft and sustainable textile sectors in India

Economic, Environmental, and Social Impacts

Economic Impact:

- Creation of a viable business model for industrial-scale natural dyes
- Expansion into international markets, generating export revenue
- Support to allied sectors such as plant raw material sourcing and processing

Environmental Impact:

- Reduction in dependency on synthetic dyes for industrial applications

- Promotion of biodegradable, plant-based colourants
- Use of renewable and waste-based raw materials

Social Impact:

- Support to craft-based dyeing communities in India through consistent supply
- Contribution to the global sustainable textile movement by offering alternatives to chemical dyes

Hind Natural Dyes (Hind Dyes) — Sustaining Generational Knowledge and Accessibility of Natural Dyes

Background and History

Hind Natural Dyes, commonly known as **Hind Dyes**, is one of India's long-standing enterprises dedicated to the manufacture and supply of natural dyes. The organization was formally established in **1995** by **Mr. Deepak Kumar Agarwal**, a dynamic entrepreneur deeply rooted in the tradition of natural dye trading. Mr. Agarwal represents the **third generation** of a family engaged in the natural dye business, carrying forward knowledge and practices that have sustained this craft over decades.



Mr Deepak Agarwal, Founder, Hind Natural Dyes

At a time when synthetic dyes had largely displaced natural colourants from mainstream textile production, Hind Dyes chose to remain committed to natural dyes, ensuring their availability for artisans, designers, and small-scale dyeing units. This long-term dedication has played a crucial role in keeping the practice of natural dyeing alive and accessible in India.

Business Model and Product Range

Hind Dyes follows a **traditional yet efficient business model** centred on the sourcing, processing, and supply of natural dye raw materials in **powdered form**. The company procures dye-yielding plants and minerals such as:

- Madder roots (*Rubia cordifolia*)
- Pomegranate rind (*Punica granatum*)
- Myrobalan (*Terminalia chebula*)
- Turmeric (*Curcuma longa*)
- Indigo (in the form of **indigo cakes**)
- Other botanical and mineral dye sources

These raw materials are **cleaned, dried, and crushed into fine powders**, making them easy to transport, store, and directly use in vessel dyeing. This form is particularly suitable for **handloom clusters, craft units, designers, educational institutions, and small dye houses**, where dyeing is carried out manually rather than in industrial machines.

Market Reach and Commercial Success

Hind Dyes has built a **robust domestic and international supply network** over nearly three decades.

Domestic Supply:

Within India, the company supplies natural dyes to multiple states, including **Gujarat, Karnataka, Uttarakhand, and Meghalaya**, catering to diverse craft traditions, handloom clusters, and independent dyers.

International Exports:

Hind Dyes also exports its natural dyes to **the United States, Europe, Australia, Mexico, and Japan**, demonstrating sustained global demand for traditionally processed natural dyes. These exports primarily serve artisans, sustainable fashion brands, craft institutions, and natural dye practitioners who prefer raw and powdered dye forms for vessel-based dyeing.

This wide market reach underscores the commercial viability of **powder-based natural dyes**, especially for decentralized, craft-oriented production systems.

Good Practices and Strengths

Hind Dyes exemplifies several good practices that make it a reliable and respected supplier in the natural dye ecosystem:

- **Consistency and continuity:** Supplying natural dyes without interruption since 1995
- **Accessibility:** Offering dyes in a form that is easy to use for beginners and experienced dyers alike
- **Preservation of traditional knowledge:** Continuing generational practices of sourcing and processing natural dye materials

- **Adaptability:** Keeping pace with changing market trends while staying rooted in traditional methods

Mr. Agarwal's long-term engagement with the sector has helped maintain trust among artisans and institutions who depend on a steady supply of authentic natural dyes.

Economic, Environmental, and Social Impacts

Economic Impact:

- Sustained livelihood generation through sourcing, processing, and trade of natural dye materials
- Support to small-scale dyers, craft clusters, and designers by providing affordable and usable dye sources
- Creation of export revenue through global supply of natural dyes

Environmental Impact:

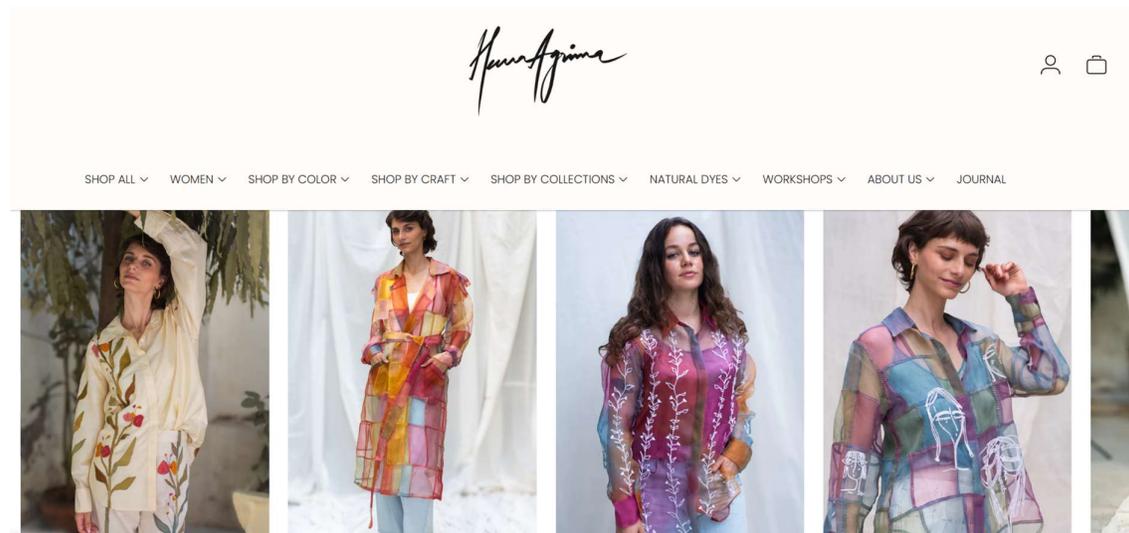
- Promotion of biodegradable, plant-based dyes as alternatives to synthetic colourants
- Encouragement of low-impact dyeing methods suited to vessel dyeing and small batches
- Reduced chemical load in craft-based textile production systems

Social Impact:

- Enabling artisans and craft practitioners across multiple Indian states to continue natural dye traditions
- Knowledge continuity across generations, reinforcing cultural heritage
- Supporting educational and training initiatives that rely on natural dyes for teaching traditional textile processes

HeenaAgrima - Slow Fashion and Natural Dye Advocacy Through Craft, Training, and Design

Background and History



HeenaAgrima website: www.heenaagrима.com

HeenaAgrima is a sustainable fashion and natural dye studio founded by **Heena Sukhani** and **Agrima Blana**, two apparel designers who share a deep commitment to ecological craft practice and zero-waste fashion. The name *HeenaAgrima* symbolizes a fusion of tradition and leadership: *Heena/henna* refers to a natural colour-giving plant widely used in Indian culture, and *Agrima* stems from a Sanskrit word denoting leadership or being at the forefront. The brand was **officially launched in 2022** but its roots extend deeper through the founders' years of study and hands-on engagement with traditional textile crafts. Together, they **have trained local artisans in India and textile professionals abroad**, including in Italy, blending global design insights with India's rich natural dye heritage.

Business and Craft Approach

HeenaAgrima stands out for its holistic integration of natural dyeing, sustainable design, and education. Rather than treating colour as a secondary aesthetic element, the brand places natural dyes at the core of its creative and production process. This means:

- **Natural raw material dyeing:** They extract colour directly from plant sources and dye textiles in open vessels using traditional methods, retaining ecological and cultural authenticity.
- **Zero-waste production:** The founders follow a strict principle of not discarding any material. Leftover dye baths, fabric cuttings (*katran*), threads, and remnants are repurposed to create new design elements or given away to artisans for reuse, reinforcing the brand's zero-waste ethos.
- **Handcrafted design:** Their apparel range includes naturally dyed garments such as dresses, shirts, and ethnic wear that celebrate the irregularity and uniqueness inherent in plant-based colour processes.

- **Workshops & knowledge sharing:** They conduct regular workshops—both online and in-studio—teaching natural dye extraction, fibre preparation, mordanting, and traditional textile techniques like eco-printing and shibori. These educational initiatives help artisans, students, and enthusiasts learn, practice, and carry forward natural dye techniques.

Products and Techniques: HeenaAgrima’s design portfolio features 100% naturally dyed garments made from fibres such as cotton and silk, all coloured using plant-based dyes like pomegranate, madder, myrobalan, turmeric, and other botanical sources. Their creative approach combines traditional textile crafts—such as dabu printing, resists, and block-printing—with contemporary fashion silhouettes. This results in clothing that is not only visually compelling but also biodegradable, non-toxic, and environmentally conscious.

Good Practices Followed:

HeenaAgrima’s operations demonstrate several exemplary practices that align closely with climate-responsive artisanal craft:

1. Zero-waste philosophy:

Nothing goes to waste in their studio—from dye baths to fabric remnants, everything is reused, upcycled, or transformed creatively into new design elements.

2. Transparent and responsible processes:

Their value system emphasises moral accountability toward the environment and community. They openly share knowledge, acknowledge craft sources, and uphold fair practices for their team and collaborators.

3. Educational outreach:

Through structured workshops—they spread traditional know-how on natural dyeing, textile preparation, and sustainable fashion, empowering learners to adopt eco-friendly practices.

4. Design and innovation:

The founders’ fashion and textile education informs a refined design practice that blends traditional craft methods with contemporary aesthetics, making natural dye garments desirable for conscious consumers.

Economic, Environmental, and Social Impacts

Economic Impact:

- HeenaAgrima supports local fabric artisans and craftsmen by sourcing skills and techniques rooted in Indian textile heritage.
- Their retail clothing line has market reach, catering to both local and global conscious consumers seeking eco-friendly fashion.

Environmental Impact:

- By relying exclusively on plant-derived dyes and zero-waste methodologies, they significantly reduce chemical pollution and textile waste.
- Their approach exemplifies *eco-design* and demonstrates how fashion can minimise ecological harm while retaining high aesthetic value.

Social Impact:

- Workshops and community engagements build skills among artisans, students, and creative individuals, fostering a renewed interest in natural dye techniques.
- Events such as masterclasses on sustainable fashion generate awareness and encourage wider adoption of natural dyeing beyond niche craft groups.

Jai Texart — Exporting Natural Dye Block Printing Through Craft Excellence and Continuous Learning

Background and Enterprise Overview

Jai Texart is a Jaipur-based textile and garment manufacturing enterprise established in **2001**, with a strong focus on **block printing and textile production using natural dyes**. Over more than two decades, the company has evolved into a successful and stable business that combines traditional craft skills with commercial manufacturing systems.



Mr Hemant Sethia, Co-Founder, Jai Texart, Jaipur

The enterprise is led by **Mr. Hemant Sethia**, an entrepreneur known for his curiosity, openness to learning, and deep enthusiasm for natural dyes. His hands-on involvement in experimentation, process improvement, and knowledge sharing has been central to Jai Texart's ability to adopt natural dyes not only as an aesthetic choice but as a core part of its production identity.

Natural Dyeing and Printing Practices

Jai Texart has developed strong in-house capacity for block printing using natural dyes, a technically demanding process that requires careful control of dye consistency, mordanting, printing paste preparation, and fixation.

Key practices include:

- **Use of natural dyes for block printing**, including plant-based colours suitable for printing pastes
- **In-house preparation of dye and print pastes**, ensuring control over colour quality

- **Vessel-based dye extraction** from natural raw materials, followed by application through printing
- **Combination of dyeing and printing**, allowing them to create layered and intricate textile surfaces

Their expertise in block printing enables the company to maintain consistency even when working with natural dyes, which are known for variability. This capability sets Jai Texart apart from many manufacturers who restrict natural dyes to small batches or experimental production.

Product Range and Manufacturing Capacity

Jai Texart operates **four dedicated printing units**, giving the company strong in-house capacity for **block printing with natural dyes**. This printing capacity produces a wide range of **natural dye block-printed fabrics and finished garments**, including:

- Export-quality block-printed fabrics
- Naturally dyed and printed apparel
- Garments designed for global boutiques as well as domestic boutiques and ethical fashion brands

The company functions as a **complete value-chain manufacturer**, managing dyeing, printing, and garment construction within its production ecosystem. This integrated approach allows better coordination between colour development, print execution, and final garment quality

Market Reach and Commercial Success

Jai Texart has established itself as a **successful exporter of natural dye block-printed textiles and garments**, serving international buyers who seek handcrafted aesthetics combined with reliable manufacturing standards. Their exports demonstrate that **natural dye printing is not limited to artisanal or niche markets**, but can be executed at commercially viable scales when supported by skill, experience, and process discipline.

The company's ability to meet export quality requirements while working with natural dyes reflects both technical expertise and operational maturity

Workshops, Training, and Knowledge Dissemination

Beyond manufacturing, Jai Texart plays a significant role in **capacity building and knowledge transfer** within the natural dye ecosystem. The company regularly conducts **natural dye training workshops** and has reportedly **trained more than 4,000 artisans** over the years.

These workshops focus on:

- Natural dye extraction from raw materials
- Mordanting and preparation of fabrics
- Application of natural dyes in dyeing and block printing

Mr. Hemant Sethia has observed that **interest and enthusiasm for learning natural dyeing techniques are often higher among international participants than domestic learners**, indicating both a challenge and an opportunity for expanding awareness and training within India.

Future Potential and Expanded Applications

Mr. Sethia strongly believes that **natural dyes have significant untapped potential beyond textiles**, particularly in:

- **Home décor**
- **Paintings and artistic applications**
- Surface design and handcrafted interiors

Such applications may allow natural dyes to thrive in areas where variation and uniqueness are seen as strengths rather than limitations.

Economic, Environmental, and Social Impacts

Economic Impact:

- Sustains long-term employment for printers, dyers, and production staff
- Demonstrates commercial sustainability of natural dye block printing over two decades
- Supports domestic and export trade in value-added craft products

Environmental Impact:

- Reduces dependence on synthetic dyes in printing and dyeing
- Promotes plant-based, biodegradable colour systems
- Encourages low-impact, skill-based textile production

Social Impact:

- Preservation of block printing and natural dyeing skills
- Training and empowerment of thousands of artisans
- Contribution to craft knowledge dissemination across India and internationally

Sam Vegetable Colours — A Legacy of Natural Dyeing from Uttarakhand

Background and Enterprise Overview

Sam Vegetable Colours, founded in 1994, is one of India's longest-standing natural dye manufacturers dedicated to producing plant-derived organic dyes and naturally dyed textiles. Although the company's origins are rooted in Moradabad, Uttar Pradesh, it operates a manufacturing and dyeing unit in **Kaladungi, district Nainital, Uttarakhand**



Mr Rachit Jain, Director, Sam Vegetables

The enterprise is a **family-run business** that has evolved over nearly three decades to become a **trusted name in natural dyes, naturally dyed fabrics, and related eco-friendly textile products**. Its journey reflects sustained commitment to traditional colour systems, ecological responsibility, and artisanal value chains.

Founding History and Evolution

Sam Vegetable Colours began in 1994, initiated by founder Mr. Mahesh Chandra Jain, who transitioned from a background in menthol cultivation and distillation to natural dyes when global interest in vegetable dyes began rising in the early 1990s.

In 2004, the company consolidated its operations under the parent entity, incorporating sister concerns *Sam-N-Ram* and *Interline Exports*. This strategic integration strengthened Sam Vegetable Colours' position as a comprehensive natural dye manufacturer and exporter.

Over the years, leadership evolved with involvement from a multi-generational team, including directors such as **Mr. Rachit Jain, Mr. Sajal Jain, and Mr. Alind Jain**, supported by a professional team including phytochemists and production specialists.

Core Products and Capabilities

Sam Vegetable Colours has developed a **diverse portfolio** that includes:

- **Natural dye powders and extracts** — sourced from plant parts, roots, bark, and organic materials, reflecting tradition and quality.
- **Naturally dyed fabrics**, including organic cotton, Khadi, linen, hemp, silk, and jute.
- **Naturally dyed handloom denim fabrics** — an innovative application that bridges tradition with contemporary textile trends.
- **Natural dyeing services** on job bases, offering natural dye application for fabrics brought by clients.
- **Natural dyes starter kits**, enabling smaller producers and learners to engage with natural dyeing processes.

The company's dyeing unit in **Kaladungi (Nainital), Uttarakhand** leverages a combination of **traditional extraction methods and sustainability-oriented production practices** to generate consistent and high-quality natural dye products.

Production and Dyeing Practices

Sam Vegetable Colours maintains an **in-house natural dye extract manufacturing unit** and a **dedicated natural dyeing facility** that allows control over quality and dye uniformity — from extraction to finished fabric.

While the company draws on traditional plant-based colour knowledge, it also incorporates **modern quality controls and dyeing techniques** to produce dyes suitable for a range of substrates. Its natural dyeing unit is capable of dyeing both **woven and knitted fabrics** and produces a **diverse spectrum of colours**, from earthy hues to vibrant natural shades, depending on the plant sources and extraction methods.

Sam Vegetable Colours has stated its ambition to expand its dyeing capacity to meet larger-scale demand, indicating growth orientation and responsiveness to market signals.

Market Reach and Commercial Positioning

The enterprise serves both the **domestic and international markets**:

- **Domestic Market:** Natural dyes, naturally dyed fabrics, and dyeing services supplied within India and neighbouring regions.
- **International Reach:** As one of India's exporter-listed natural dye suppliers, the company supplies dyes and services to overseas buyers looking for sustainable textile inputs.

Its product range and manufacturing orientation position Sam Vegetable Colours as a **comprehensive natural dye solution provider** — combining raw dye production, fabric dyeing, and finished sustainable textiles.

Sustainability and Environmental Orientation

Sam Vegetable Colours emphasizes environmental responsibility throughout its operations:

- Use of **plant-derived colourants** and avoidance of synthetic chemical dyes reflecting ecological consciousness.
- A manufacturing philosophy rooted in **eco-friendly practices and quality assurance**, ensuring dyes are free from harmful substances.
- An operational model that blends **traditional dye heritage with responsible raw material sourcing and processing practices**, thereby contributing to sustainable textile ecosystems.

The company's products — both dyestuffs and naturally dyed fabrics — align with consumer demand for **non-toxic, biodegradable, and culturally connected textiles**.

Challenges and Sector Realities

While Sam Vegetable Colours has sustained operations for nearly three decades, the broader natural dye industry continues to face structural challenges, including:

- Managing **colour fastness and reproducibility**, a technical constraint common to plant-based dyes.
- Competing with synthetic dyes in markets where synthetic alternatives are cheaper and more uniform.
- Educating customers on the **value proposition of naturally dyed textiles**, especially with respect to sustainability and long-term ecological benefits.

Social and Economic Impacts

Employment and Skill Creation:

Sam Vegetable Colours provides employment to specialized dyeing personnel, weaving units, and production teams, including seasoned natural dyers with decades of experience.

Craft and Heritage Support:

By sustaining demand for naturally dyed fabrics and dyes, the company indirectly supports traditional weaving and colour practices that contribute to cultural continuity.

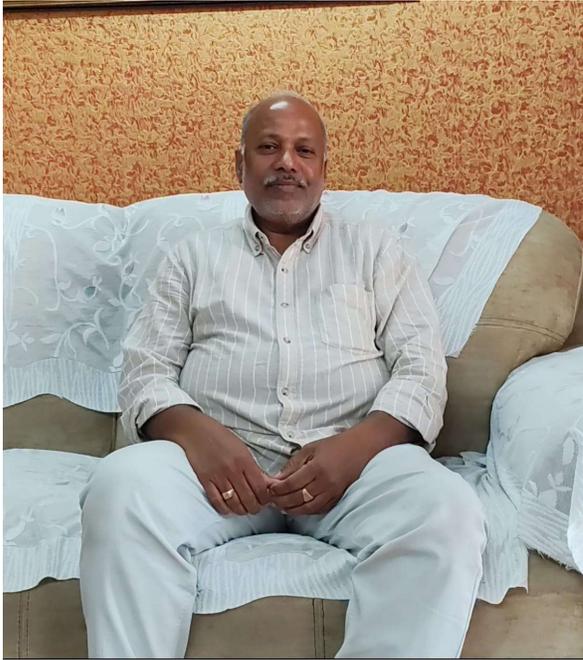
Market Development:

Its natural dye starter kits and fabric offerings help smaller artisans and designers experiment and integrate natural dyes in their own products.

Key Insights and Learnings

- Sam Vegetable Colours illustrates how a **family-run natural dye enterprise can evolve into a manufacturing and dyeing hub** while staying rooted in traditional ecological knowledge.
- Its **in-house vertical integration** (from extraction to dyeing and finished products) strengthens quality control and market relevance.
- Operating from **Nainital, Uttarakhand**, while maintaining an office in Moradabad, demonstrates **geographical linkage between craft ecosystems and production hubs**.

Shilp Guru Shri Gopal Prasad Sharma — Sustaining India’s Painting Traditions Through Mineral-Based Natural Colours



Background and Recognition

Shri Gopal Prasad Sharma is a highly respected traditional Indian painter and master artisan, formally recognised with the prestigious title of Shilp Guru for his exceptional contribution to Indian heritage arts. Over the years, he has also been nominated multiple times for the Padma Shri, reflecting national acknowledgement of his mastery, dedication, and cultural impact.

Mr. Sharma represents a lineage of artists for whom painting is not merely a profession, but a disciplined cultural practice rooted in knowledge of materials, nature, and technique. His work stands as a living example of how traditional mineral-based colour systems continue to thrive when supported by skill, patience, and deep understanding.

Traditional Knowledge of Natural Colours in Painting

At the core of Mr. Sharma’s artistic practice is the use of **natural colours derived from stones and minerals**, a method historically followed across India in miniature paintings, murals, temple art, and manuscript illumination.

According to Mr. Sharma, **all traditional Indian paintings originally relied on natural colours**, long before the introduction of synthetic pigments. These colours were prepared manually by the artist, making colour preparation an integral part of the creative process rather than a separate technical step.

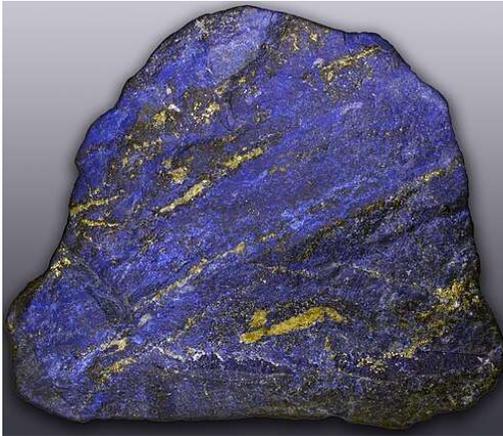
Sources of Natural Mineral Colours

Mr. Sharma uses a range of **naturally occurring stones and minerals** to derive pigments for his paintings, including:

- **Ochre**(Local name: **Peoli for yellow ochre; tana phun for red ochre**) – yielding earthy yellow, red, and brown tones



- **Lapis Lazuli** – producing deep, rich blue shades



- **Malachite** – used for vibrant green pigments



- **Rasod** – traditionally used for yellow and ochre tones



- **Mica** – providing shimmering and reflective effects



- **24-carat gold** – applied for detailing, ornamentation, and sacred motifs

- **Gond Stone** – yellow colour.



- **Khadiya stone chalk** – white base



- **Hematite (Local name : Rasod)** – Brown colour



- **Hematite (local name: Red geru/Singrakh) – red colour**



These materials are carefully sourced, processed, and transformed into fine pigments through traditional grinding and purification techniques.

Process of Colour Preparation and Application

Mr. Sharma emphasises that **natural colour preparation is a disciplined, multi-step process** requiring time, patience, and experience:

1. Stones are cleaned and selected for purity
2. They are manually ground into fine powders
3. Pigments are repeatedly washed and refined
4. Natural binders are added to achieve the desired consistency
5. Colours are applied layer by layer with precision

This process ensures depth, harmony, and longevity in the artwork. According to him, **colour preparation itself is a form of meditation**, strengthening the artist's connection with the artwork and nature.

Aesthetic, Cultural, and Environmental Value

Mr. Sharma highlights that mineral-based natural colours offer qualities unmatched by synthetic paints:

- **Softness and depth of colour**
- **Visual harmony and balance**
- **Graceful ageing over time**, rather than sudden fading or cracking

From an environmental perspective, he considers natural mineral colours to be **eco-friendly and sustainable**, as they avoid the chemical load associated with synthetic pigments. For him, working with natural materials is an ethical choice that respects both nature and tradition.

Challenges and Concerns

Despite his success, Mr. Sharma expresses concern about the **decline of traditional colour knowledge**. He observes that many contemporary artists rely entirely on ready-made synthetic paints, leading to the gradual loss of skills related to pigment preparation and material understanding.

He stresses that unless these techniques are **documented, taught, and practiced**, they risk disappearing with the older generations of artists.

Knowledge Transmission and Role as Shilp Guru

As a Shilp Guru, Mr. Sharma sees teaching and mentoring as a core responsibility. He believes that:

- Artists must actively practice natural colour preparation
- Knowledge should be passed through **hands-on learning**, not theory alone
- Institutions and cultural projects should support traditional material-based training

His role extends beyond individual artistic practice to **preserving a cultural ecosystem of knowledge**.

Economic, Environmental, and Social Impact

Economic Impact:

- Sustained livelihood through heritage art rooted in traditional materials
- Recognition and market value for paintings created using authentic techniques

Environmental Impact:

- Use of non-toxic, mineral-based pigments
- Minimal environmental footprint compared to chemical paints

Social and Cultural Impact:

- Preservation of ancient Indian painting traditions
- Inspiration to younger artists to reconnect with natural materials
- Strengthening India's cultural identity through authentic practice

K.Shiva Reddy - Preserving Kalamkari through Natural Colours and Narrative Traditions

Background and Journey

K. Shiva Prasad Reddy was born into a farming family in Tangutur, Andhra Pradesh. With no artistic lineage in his family and limited financial means, he had to discontinue his formal education at an early stage to support agricultural work at home. However, his passion for art remained strong.



Determined to pursue Kalamkari despite family resistance, he left home and enrolled in a two-year Kalamkari training course in Srikalahasti, Chittoor district. This bold decision transformed his life and laid the foundation for his journey as a master artisan.

Today, at 70 years of age, Reddy continues to practice and promote Kalamkari with the same dedication and discipline that marked the beginning of his career.

Artistic Excellence and Recognition

K. Shiva Prasad Reddy is widely recognized for his mastery in hand-painted Kalamkari on textiles. His large-scale narrative works depict mythological and scriptural themes drawn from the *Mahabharata*, *Ramayana*, and Buddhist traditions.

One of his most notable achievements includes a monumental Kalamkari artwork completed in 2002, depicting nearly 1,926 characters from Indian epics — a work that earned recognition in the Limca Book of Records.

His major recognitions include:

- **State Award** for *Life of Buddha* (1995)
- **State Award** for *Hanuman Ramayana* (2000)
- **UNESCO-CCI Seal of Excellence** for *Tree of Life* (2004)
- **Shilp Guru Award** (2015)
- **Mahakavi Kalidas Award** (2025)

He established a **Kalakshetram dedicated to Kalamkari**, where he trains younger artisans and ensures transmission of traditional knowledge.

Use of Natural Colours in Kalamkari

Reddy has been working with natural colours for over 45 years. Traditional Kalamkari relies entirely on plant-based, mineral-based, and earth-derived pigments.

Sources of Natural Colours

- **Blue:** Indigo plants
- **Red:** Manjistha (Madder) roots
- **Black:** Iron solution
- **Yellow:** Plant extracts and floral sources
- **Light Brown:** Soil and mineral pigments
- **Orange & Yellow:** Basant flowers

The colours are fixed using traditional mordants such as:

- Alum (Fitkari)
- Jaggery
- Iron solution

Babool (acacia) gum is added to improve adhesion and thickness of the pigments on fabric.

Cultural and Environmental Significance

According to Reddy, natural colours are essential not just for technical reasons, but for cultural authenticity.

In traditional Kalamkari:

- Gods are depicted in blue tones
- Demons in red and green hues
- Mythological narratives gain symbolic depth through colour

Natural dyes ensure longevity and aesthetic integrity of artworks. Unlike synthetic alternatives, they:

- Do not pollute water systems
- Contain no harmful chemicals
- Support environmentally sustainable craft production
- Maintain the spiritual and symbolic character of traditional art

Market Presence and Demand

Reddy's works are regularly showcased at:

- National handicraft exhibitions
- Artisan fairs
- Surajkund Mela

He maintains a steady order base for natural dye-based Kalamkari paintings. In recent years, increased awareness about authentic natural dyes has led to renewed demand.

Challenges in the Sector

Despite his success, several challenges persist:

1. Colour Consistency and Stability

Natural dyes require complex extraction and fixation processes. Variations in climate and raw material quality affect shade consistency.

2. Time-Intensive Process

Traditional Kalamkari involves multiple stages of:

- Washing
- Mordanting
- Sun drying
- Repeated dye applications

This makes production slower compared to synthetic alternatives.

3. Market Duplication

One of the biggest challenges today is duplication. Synthetic-painted artworks are often sold as "natural" at lower prices, misleading consumers.

Customers often lack the ability to distinguish between genuine natural dye Kalamkari and chemically produced imitations.

Way Forward and Future Outlook

Reddy believes that the future of natural dye Kalamkari is promising due to:

- Rising environmental consciousness
- Growth in sustainable fashion
- International demand for chemical-free textiles
- Expanding digital platforms reaching younger audiences

He emphasizes the need for:

- Stronger GI tag enforcement
- Certification and authenticity mechanisms
- Eco-friendly branding
- Digital marketing support for artisans

With increasing awareness and proper market regulation, he believes natural Kalamkari will regain and strengthen its rightful position in both domestic and international markets.

Tuneshwar Thakur - *Reviving Natural Colours in Madhubani*

Background and Artistic Journey

Tuneshwar Thakur belongs to Rayyam village in Madhubani, Bihar—one of the historic centers of Mithila art. Although no one in his immediate family was engaged in Madhubani painting or Sikki craft, his uncle, Kauleshwar Thakur, a State Awardee artist, practiced both Sikki weaving and Madhubani painting.



Inspired by his uncle's work, Tuneshwar began sketching on paper at a young age. Recognizing his interest, his uncle mentored him informally, explaining traditional iconography—such as depictions of Goddess Saraswati and Goddess Lakshmi—and guiding him in colour combinations and composition. This oral transmission of knowledge laid the foundation for his artistic development.

Unlike many contemporary practitioners, Tuneshwar developed a strong inclination toward working with natural colours from the very beginning of his practice.

Engagement with Natural Colours

Tuneshwar's journey with natural colours evolved gradually through experimentation and self-learning. He has never received formal training in natural dye preparation; instead, he developed his knowledge through observation, practice, and traditional community wisdom.

Early Experiments

Initially, he painted using:

- Cow dung mixed with bel (wood apple) gum
- Smooth village clay for wall painting

Over time, he began extracting colours from flowers, leaves, soil, and natural materials for use on cloth and paper.

Sources of Natural Colours Used

- **Red:** Sanjha and Hibiscus flowers
- **Black:** Ash from clay stove
- **Orange & Yellow:** Marigold flowers
- **Blue:** Aparajita (Butterfly Pea) flowers
- **Green:** Semal leaves
- **Golden Yellow:** Turmeric
- **Brown:** Soil and cow dung

To create viscosity and adhesion, he mixes:

- Babul gum or bel pulp

This acts as a natural binder, similar to commercial adhesives, ensuring better application and durability of colour on paper or fabric.

Philosophy and Importance of Natural Colours

According to Tuneshwar, natural colours are:

- Completely chemical-free
- Environmentally friendly
- Safe for human health
- Biodegradable

He highlights that chemical-based colours can harm the environment and prolonged exposure may negatively impact respiratory health. In contrast, natural colours do not produce harmful fumes and align with ecological sustainability.

Artistically, he believes that natural colours offer subtle textures and tonal depth that cannot easily be replicated by synthetic paints. The earthy aesthetic enhances the authenticity of Madhubani art.

Capacity Building and Community Engagement

Between 2018 and 2022, Tuneshwar conducted 15–20 training sessions in schools across Bihar through the NGO *Going to School*. Each session included:

- One hour of theoretical understanding

- One hour of practical training

These sessions introduced students to Madhubani painting techniques and natural colour preparation, thereby promoting environmental awareness through art education.

In addition to his artistic practice, he has also worked as a Center Head under the Government of Bihar's Pradhan Mantri Kaushal Yojana and contributed as an ITMIS Expert, reflecting his administrative and training capabilities.

Market Realities and Production Scale

Despite his commitment to natural colours, Tuneshwar notes that market demand for natural-colour-based Madhubani paintings remains limited. Such artworks require significant time, labour, and raw material preparation but often do not fetch proportionate prices.

As a result, he currently produces only 3–4 natural colour paintings annually.

Recently, representatives from *Sanjha Art Gallery* approached him to create Sikki pasting and Madhubani artworks using natural colours for online display, indicating growing niche interest in eco-friendly art.

Challenges in Using Natural Colours

Tuneshwar identifies several key challenges:

1. Limited Availability of Raw Materials

Natural colours depend on seasonal flowers, leaves, and soil, making year-round availability difficult.

2. Restricted Colour Range

Achieving vibrant and varied shades is more challenging compared to synthetic paints.

3. Colour Fastness Issues

Some natural colours fade over time or are not fully light-fast.

4. Labour-Intensive Preparation

Collecting, cleaning, grinding, and processing raw materials is time-consuming and physically demanding.

5. Low Market Demand

Higher production time and cost are not always reflected in selling prices.

Adaptive Strategies

To overcome these challenges, he:

- Uses seasonal and locally available materials
- Stores small quantities of flowers and leaves
- Keeps artworks away from sunlight and moisture
- Uses acid-free paper or canvas
- Stores paintings in cool, dry, and ventilated conditions

These measures help preserve the integrity and longevity of his natural colour artworks.

Future Outlook

Tuneshwar believes the future of natural-colour-based products is promising due to:

- Growing environmental awareness
- Increasing demand for eco-friendly products
- Government and international support for sustainable crafts
- Global appreciation for heritage-based authenticity

He emphasizes that natural colours align with contemporary consumer values—health-conscious, environmentally responsible, and culturally rooted.

Furthermore, natural dye practices can generate employment in rural and tribal areas, strengthening local economies while preserving traditional knowledge systems.

Chapter 6

Innovations and Climate-Responsive Practices

New Techniques Integrating Traditional and Modern Methods

As climate change, resource scarcity, and environmental degradation increasingly affect craft and textile ecosystems, innovation in natural dyeing and traditional art practices has become essential. However, innovation in this context does not mean replacing traditional knowledge; rather, it involves strengthening traditional practices through selective integration of modern techniques, tools, and scientific understanding as follows:

1. Scientific Refinement of Traditional Processes

Examples include:

- Optimising temperature, pH, and extraction time for plant-based dyes to improve colour yield
- Using controlled grinding and filtration techniques for mineral pigments to achieve finer particle size
- Standardising mordant concentrations to reduce excessive use of metal salts

Such refinements help artisans achieve better results without compromising the natural character of the colours.

2. Hybrid Extraction Techniques

- Use of mechanical grinders instead of manual grinding for stones and roots, reducing physical strain
- Introduction of low-impact solvent or aqueous extraction systems (as seen in industrial natural dye manufacturers) to produce cleaner and more consistent dye liquors
- Improved filtration and settling techniques to remove plant residue and impurities

These methods retain the essence of natural dyes while making them suitable for larger-scale or repeat production.

3. Integration with Modern Dyeing and Printing Equipment

Traditionally, natural dyes were limited to hand dyeing and small vessels. Innovations now enable their use in:

- Jigger and cabinet dyeing machines using refined dye extracts
- Block printing with controlled printing pastes made from natural dyes

- Adapted screen printing techniques for small-batch natural dye applications

This integration allows natural dyes to move beyond niche craft settings into small and medium-scale production systems.

4. Climate-Responsive Dyeing Techniques

Innovative practices are also emerging that respond directly to climate concerns:

- Solar dyeing, which uses sunlight instead of fuel-based heating
- Fermentation-based dyeing (such as indigo vats), which relies on biological processes rather than chemicals
- Cold dyeing and low-temperature extraction, reducing energy consumption

These methods significantly reduce carbon footprint and align closely with climate-responsive craft principles.

5. Water Management and Circular Practices

Modern innovations increasingly focus on responsible water use, a critical concern in dyeing processes:

- Reuse of dye baths for lighter shades
- Settling and filtration of wastewater for secondary use
- Composting of spent dye material and plant residues
- Integration of natural dyeing with circular economy models, where waste from one process becomes input for another

Such practices make traditional dyeing more viable in water-scarce regions.

6. Expanding Natural Colours Beyond Textiles

Another important innovation is the application of natural colours in new domains, such as:

- Paintings and fine art using mineral pigments
- Home décor products such as wall panels, murals, and handcrafted surfaces
- Eco-printed paper and mixed-media artworks

7. Knowledge Sharing Through Documentation and Training

Modern tools are also transforming how traditional knowledge is preserved and shared:

- Creation of handbooks, digital archives, and visual guides
- Workshops combining hands-on practice with technical explanation
- Collaboration between artisans, designers, researchers, and institutions

This ensures that innovations remain accessible and rooted in craft communities rather than becoming exclusive or industrialised.

Use of invasive species such as *Lantana Camara* for environment benefit.

While many natural dye initiatives focus on native dye-yielding plants, invasive species such as *Lantana camara* present a unique opportunity to link **ecological restoration with sustainable craft practice**. Long regarded as a noxious weed and ecological threat, *Lantana camara*'s abundant biomass and widespread occurrence can be harnessed in ways that provide **climate-responsive environmental and economic benefits**.

What Is *Lantana camara* and Why Does It Matter?

Lantana camara is a **shrub native to tropical America** that was introduced into India many decades ago, initially for ornamental planting. Over time, it has become one of the **most aggressive invasive species in Indian ecosystems**, earning it listings among the “world’s worst invasive weeds.”

Ecological Impact

- *Lantana* invades forests, grasslands, and degraded landscapes across large parts of India, often forming dense thickets that suppress native vegetation and hinder biodiversity recovery.
- In Indian forests, it has been estimated to occupy **43–44 % of forest cover**, an area larger than many countries.
- It disrupts native plant seedling growth, reduces species diversity, and alters ecosystem structure through inhibition of other plant growth.
- *Lantana* foliage and seeds contain toxic compounds that are harmful to grazing livestock, contributing to additional ecological stress.

Because of its rapid spread and ecological harm, *Lantana camara* is classified as **invasive** under biodiversity and conservation criteria in India.

Turning a Problem into a Resource: Environmental and Craft Benefits

1. Biomass Utilisation

One of the most promising avenues is to utilise the **abundant biomass of *Lantana*** rather than merely treating it as waste. Removal efforts for ecological restoration can generate large volumes of plant material that would otherwise require disposal.

Potential uses include:

- **Natural dye extraction:** Exploration of *Lantana* as a dye source—leaves, stems, and flowers contain pigments and tannins that can be investigated for textile or craft dyeing.
- **Activated carbon production:** Research shows *Lantana* stems can be processed into **activated carbon**, useful for wastewater filtration and adsorption applications.
- **Nanomaterial fabrication:** Scientists have used *Lantana* extracts as reducing and stabilising agents in producing **eco-friendly nanoparticles** (e.g., titanium dioxide).
- **Craft materials:** Dried *Lantana* wood and branches can be used to make **handicrafts, baskets, furniture, and bio-composite products** in rural enterprises, as part of value-addition strategies offering alternate means of livelihood for the community people.

2. Dye Potential and Craft Integration

While *Lantana* isn't as well established as traditional plant dyestuffs, its **pigment content (tannins and flavonoids)** suggests potential for natural dye development in craft contexts:

- Pigment extraction methods similar to other tannin-rich species can be adapted.
- Dye liquor can possibly yield **earthy yellows, greens, or browns** depending on mordants and extraction conditions.
- Using *Lantana* as a raw dye source aligns with circular ecology: *removal for ecosystem health → resource for sustainable craft → income generation*.

Integrating *Lantana* biomass into dye systems reduces pressure on native species while contributing to **landscape restoration**.

Linking Ecological Restoration with Livelihoods

Projects and experts have noted that converting invasive plant biomass into usable products can **generate livelihoods while improving ecosystems**. For example, forestry initiatives recommend converting invasive plant removal into **training and value chain development for paper, handicraft, and charcoal products** to engage local communities in ecological work.

This approach creates **dual benefits**:

- **Ecological restoration:** Clearing *Lantana* helps native vegetation recover, improving habitat quality for wildlife and restoring grasslands needed for herbivores.
- **Economic opportunity:** Turning biomass into dyes, craft materials, or industrial inputs supports rural enterprises and reduces waste.

Lantana camara is a striking example of how a problematic invasive species can be reframed as a **resource for climate-responsive, sustainable craft practice**. By integrating *Lantana* biomass into dyeing, material innovation, and product creation, communities can simultaneously contribute to **ecosystem health, livelihood diversification, craft sustainability, and environmental awareness**—turning an ecological threat into an opportunity for positive change.

Chapter 7

Workshop Learnings and Field Experiences

As part of the **British Council's Climate Futures South Asia Programme**, under the project: **Mapping Nature's Palette for Climate-Responsive Artisanal Practices**, two capacity-building workshops on **Natural Dye Extraction and Application** were conducted in Uttarakhand on **26th and 27th October 2025**.

These workshops aimed to revive traditional knowledge, promote eco-friendly craft practices, and enhance the livelihood skills of local women artisans.

The initiative is aligned with the program's goals of enabling communities to adopt **sustainable, climate-friendly craft techniques** while preserving indigenous knowledge systems related to natural colour extraction and textile dyeing.

Objectives of the Workshops

Primary Training Objectives

1. **To train local artisans in extracting natural dyes** from locally available raw materials such as leaves, flowers, bark, food waste, roots, and seeds.
2. **To teach artisans the application of natural dyes** on fibres, yarns, and textiles using hands-on, experiential learning methods.

Additional Objectives

- **Capacity building** of participating women, youth, and local artisans.
- **Promoting environment-friendly craft practices** by reducing dependence on chemical dyes.
- **Preserving traditional Indian knowledge** of natural dye extraction and usage.
- **Raising awareness** about the ecological, cultural, and economic importance of natural dyes.
- **Encouraging artisans** to adopt sustainable livelihood options and create value-added craft products.

Workshops and the Learnings

The workshops conducted under this project provided valuable insights into the **real-world dynamics of introducing natural dyeing and sustainable practices**

among artisan communities. Beyond technical training, **these workshops became spaces of learning, negotiation, adaptation, and trust-building**. The experiences highlighted that transitioning to climate-responsive craft practices is not only a technical process but also a **social and behavioural journey**, especially when working with women artisans from diverse educational and economic backgrounds.

7.1 Diversity of Participants and Learning Levels

One of the most significant observations was the **wide diversity among participating women artisans**:

- Some participants had **prior exposure to textiles**, yarn handling, or basic dyeing processes
- Others were **completely new** to dyeing and textile concepts but wanted to learn in order to earn livelihood through this means.
- Literacy levels varied, with many participants **unable to read measurements or written instructions**
- Awareness of sustainability ranged from **high appreciation** to **complete unfamiliarity or indifference**

This diversity required trainers to **continuously adapt language, teaching methods, and pacing**, ensuring inclusivity without overwhelming beginners or disengaging experienced participants.

7.2 Perception of Sustainability: Appreciation vs Practical Reality

While some participants resonated strongly with ideas of **environmental protection, natural processes, and traditional knowledge**, others questioned the relevance of sustainability to their daily lives.

Key challenges observed:

- Many felt that **“life is already going on fine”** with synthetic dyes and coloured yarns
- Sustainability was often seen as **abstract or elite**, not directly linked to income
- Immediate economic needs often outweighed long-term environmental concerns

This reinforced the importance of **linking sustainability to tangible benefits**, such as:

- Reduced health risks
- Lower long-term costs
- Market demand for natural and eco-friendly products

7.3 Challenge of Mobilisation and Trust Building

One of the earliest and biggest challenges was **gathering participants and convincing them to attend** the workshops.

Observed issues included:

- Reluctance to invest time in unfamiliar practices
- Skepticism about the usefulness of natural dyeing
- Fear of losing income if new techniques failed

Overcoming this required:

- Multiple community interactions
- Demonstrations rather than explanations
- Peer-to-peer encouragement once early adopters showed interest

7.4 Teaching Natural Dyeing to not so literate Artisans

Natural dyeing involves **proportions, timing, and sequencing**, which can be difficult to communicate without literacy or numeracy.

Use of Relative Measurements

Instead of percentages and formulas, trainers used:

- **Weight-based comparisons** (e.g., “equal weight of raw material and fabric”)
- Visual cues such as **handfuls, bowls, or bundles**
- Repeated demonstrations to reinforce learning

For example:

- Explaining dye ratios as *“one bundle of dye plant for one bundle of fabric”*
- Showing how **increasing raw material quantity deepens shade intensity**

This hands-on, comparative approach proved far more effective than theoretical explanation.

7.5 Understanding Shade Depth and Colour Intensity

A common learning curve involved helping artisans understand that:

- **Deeper shades require more raw material**, longer dyeing time, or repeated dips
- Light and dark shades can be achieved from the **same dye source**, depending on concentration

Many participants initially expected **instant and uniform results**, similar to synthetic dyes. Over time, they learned to appreciate:

- Gradual colour development
- Natural variation as an aesthetic quality
- The need for patience in natural dyeing

7.6 Water Quality and Regional Challenges

Water hardness emerged as a **critical technical challenge**, varying from location to location (workshop was conducted at two different locations each having different quality of water):

- Hard water affected colour brightness and uptake
- The same dye recipe produced different results in different areas
- Artisans found it confusing when results did not match demonstrations

This highlighted the need to:

- Test water quality before dyeing
- Adapt mordants and processes locally
- Emphasise experimentation rather than fixed recipes

7.7 Introducing Natural Mordants: A Conceptual Challenge

One of the most difficult concepts for participants was understanding the role of **mordants**, especially natural ones.

Challenges included:

- Confusion about why additional materials were required
- Resistance to extra steps that increase time and effort
- Difficulty distinguishing between **synthetic chemicals** and **natural mordants**

Trainers had to repeatedly explain that:

- Mordants such as **alum** or **plant-based tannins** are essential for colour fixation
- These substances are naturally occurring and safer than synthetic chemicals
- Mordanting improves colour longevity and usability

Visual demonstrations—showing dyed fabric with and without mordant—were crucial in building understanding.

7.8 Managing Expectations: Natural vs Synthetic Dyeing

Many artisans initially compared natural dyes directly with synthetic dyes, expecting:

- Faster results
- Brighter and uniform colours
- Minimal process steps

Through repeated engagement, participants gradually understood that:

- Natural dyeing is **process-oriented**, not instant
- Variations are natural and acceptable
- Skill improves outcomes over time

This shift in mindset was one of the most important learning outcomes.

7.9 Behavioural and Attitudinal Learnings

Key behavioural observations included:

- Greater enthusiasm once participants **successfully dyed their first piece**
- Increased curiosity when results were visibly different from synthetic dyes
- Peer learning becoming more effective than trainer-led instruction

Workshops demonstrated that **confidence and ownership** develop only through repeated practice.

7.10 Key Learnings from Field Experiences

- Technical training must be paired with **social and psychological understanding**

- Sustainability needs to be framed as **livelihood enhancement**, not moral obligation
- Teaching methods must adapt to **low literacy contexts**
- Natural dyeing success depends heavily on **local water, materials, and conditions**
- Patience, repetition, and trust are as important as technical accuracy

The workshops revealed that adopting natural dyeing and climate-responsive craft practices is a **gradual, layered process**. While technical challenges exist, the deeper challenge lies in **changing mindsets, building confidence, and making sustainability meaningful in everyday life**.

Chapter 8

Practical Toolkit

This chapter serves as a **hands-on guide** for artisans, trainers, and practitioners working with natural dyes and traditional colour practices. It translates concepts discussed in earlier chapters into **actionable tools, simple recipes, and easy documentation formats** that support consistent, safe, and sustainable dyeing practices in real-world conditions.

8.1 Checklist for Artisans

A. Basic Tools Required

Dyeing & Preparation Tools

- Large vessels (aluminium / stainless steel / earthen pots)
- Wooden or stainless steel stirring sticks
- Measuring containers (cups, bowls, mugs)
- Strainers or cloth for filtering dye liquor
- Weighing scale (preferred) or standardised bowls
- Buckets and tubs for washing and rinsing

Processing Tools

- Grinding stone / mortar / mechanical grinder
- Drying racks or clean ropes

B. Materials Required

Natural Dye Sources

- Plant-based materials (roots, bark, leaves, flowers, fruits)
- Animal-based dyes (e.g., lac)

Mordants (Preferably Natural or Low-Impact)

- Alum (Potash alum)
- Iron solution (ferrous sulphate through mineral sources)
- Tannins from plants (myrobalan, pomegranate rind, tea waste)

Fibres & Materials

- Cotton
- Silk
- Wool
- Yarn or fabric (washed and clean)

C. Safety Checklist

- Wear **gloves** when handling mordants
- Avoid direct inhalation of fine powders
- Do not use dye vessels for cooking
- Work in **well-ventilated areas**
- Keep children away from hot dye baths
- Label all solutions clearly

8.2 Dye Recipes by Fibre Type

Natural dyeing depends heavily on the type of fibre being dyed. Fibres are broadly classified into **protein fibres** and **cellulosic fibres**, each requiring different preparation.

8.2.1 Protein Fibres (Silk, Wool)

Protein fibres accept natural dyes more easily and usually require **milder mordanting**.

General Recipe (Protein Fibres)

Material-to-Dye Ratio (Basic):

- 1:1 (Equal weight of dye material and fibre for medium shade)

Steps:

1. **Scouring**
 - Wash fibre gently with mild soap
 - Rinse thoroughly
2. **Mordanting**
 - Alum: 10–15% of fibre weight
 - Soak fibre for 30–45 minutes in warm mordant bath
3. **Dye Extraction**
 - Boil dye material in water for 45–60 minutes
 - Strain to obtain clear dye liquor

4. Dyeing

- Add mordanted fibre to dye bath
- Maintain low to medium heat
- Stir gently for even colour

5. Rinsing & Drying

- Rinse in cool water
- Dry in shade

8.2.2 Cellulosic Fibres (Cotton, Linen)

Cellulosic fibres require **more preparation**, especially for good colour fixation.

General Recipe (Cellulosic Fibres)

Material-to-Dye Ratio (Basic):

- 1:2 (More dye material needed for cotton)

Steps:

1. Scouring

- Boil fabric with soda ash or natural soap
- Remove starch, oil, and dirt

2. Tannin Treatment (Optional but Recommended)

- Use myrobalan / pomegranate rind
- Soak fabric for 1–2 hours

3. Mordanting

- Alum: 15–20% of fibre weight

4. Dye Extraction & Dyeing

- Same as protein fibres
- Longer dyeing time often required

5. After-Treatment

- Iron or plant tannin dip for shade variation

Shade Control Tips

- **More dye material → deeper shade**
- **Repeat dyeing → stronger colour**
- **Iron mordant → darker, muted tones**
- **Alum → brighter shades**

8.3 Simple Dye Recipe Reference Table

| Fibre Type | Mordant | Dye Ratio | Shade Outcome |
|------------|------------------|-----------|---------------|
| Silk | Alum | 1:1 | Bright, clear |
| Wool | Alum + Iron | 1:1 | Deep, muted |
| Cotton | Tannin + Alum | 1:2 | Medium |
| Cotton | Iron (after dip) | 1:2 | Grey / dark |

8.4 Templates for Record-Keeping and Documentation

Documentation helps artisans **repeat successful results**, understand failures, and improve over time.

Template for Dyeing Record Sheet

Date:

Location / Water Source:

Fibre Type:

Weight of Fibre:

Dye Material Used:

Weight of Dye Material:

Mordant Used:

Dye Method: (Boiling / Fermentation / Solar)

Time & Temperature:

Final Shade Observed:

Remarks / Learnings:

This Practical Toolkit empowers artisans to **practice, experiment, and improve** natural dyeing independently. By combining **simple recipes, visual logic**, and **basic recordkeeping**, it bridges the gap between traditional knowledge and contemporary sustainability needs—making climate-responsive craft practices achievable and repeatable.

Chapter 9

Digital and Multimedia Integration

In today's interconnected world, the sustainability of traditional crafts depends not only on practice and training, but also on **visibility, accessibility, and knowledge sharing through digital platforms**. This chapter outlines how digital and multimedia tools have been integrated to extend its reach beyond physical workshops and to create lasting educational and advocacy resources.

9.1 Natural Colours for a Sustainable Future – Awareness Video

The “**Natural Colours for Sustainable Future**” video has been developed as a core awareness tool to communicate the relevance of natural dyes and traditional colour practices in the context of climate change and environmental sustainability. Through visuals of raw materials, dyeing processes, and artisan participation, the video presents natural colours as a **viable, culturally rooted alternative** to synthetic systems.

9.1 Natural Colours for a Sustainable Future – Awareness Video

“**Natural Colours for a Sustainable Future**” is a flagship programme conceptualised and implemented by **Tri-Impact**, with support from the **British Council under its Climate Futures Programme**. The initiative aims to highlight the relevance of natural dyes and traditional colour practices as climate-responsive, environmentally sustainable alternatives within the textile and craft sectors.

As part of this programme, Tri-Impact organised **two intensive capacity-building workshops** focused on:

- **Extraction of natural dyes from locally available raw materials, and**
- **Application of natural dyes on textiles using sustainable dyeing techniques**

These workshops were designed not only as skill-development interventions, but also as platforms to **communicate the ecological, cultural, and economic relevance of natural dyes** in the context of climate change, biodiversity conservation, and sustainable livelihoods.

Below link shows a video demonstrating this initiative of Tri-Impact:

[Youtube.com/..... Natural Colours for Sustainable Future video](#)

9.2 Workshop Testimonials: Artisans' Voices and Lived Experiences

An integral component of the **Natural Colours for a Sustainable Future** programme was the documentation of **artisan voices through short testimonial videos**. These testimonials capture the lived experiences of women participants who took part in the natural dye extraction and application workshops organised by Tri-Impact under the British Council's Climate Futures Programme.

Through these testimonials, participants share their learning journeys—ranging from initial hesitation and curiosity to a deeper understanding of natural dyes, their environmental benefits, and their potential as livelihood options. The videos also document challenges faced by learners, such as adapting to new techniques, understanding measurements, and working with natural materials.

By presenting unfiltered artisan perspectives, these testimonial videos add authenticity and credibility to the programme. They serve as powerful digital tools for outreach, motivation, and peer learning, and are disseminated through social media platforms such as Instagram and YouTube to reach wider artisan and craft communities.

[Natural Dye Workshop Testimonial No. 1](#)

[Natural Dye Workshop Testimonial No. 2](#)

[Natural Dye Workshop Testimonial No. 3](#)

[Natural Dye Workshop Testimonial No. 4](#)

[Natural Dye Workshop Testimonial No. 5](#)

9.3 Digital Documentation of Case Studies and Success Stories

To demonstrate the commercial, artistic, and social viability of natural dyes, the programme digitally documents a series of **case studies and success stories** across different scales and contexts. These stories showcase diverse models of engagement with natural dyes—from small-scale craft practices to organised manufacturing and heritage art forms.

The documented success stories include following enterprises through interview of their founder members describing their success stories and how they navigated through all challenges:

- **Sodhani Biotech, Jaipur** – innovation in natural dye extraction and global supply
- **Hind Dyes, Jaipur** – generational continuity in natural dye sourcing and supply
- **Jai Texart, Jaipur** – commercial block printing and garment production using natural dyes
- **Shilp Guru Gopal Prasad Sharma, Jaipur** – use of mineral-based natural colours in traditional painting
- **Sam Vegetable Dyes, Moradabad** – vegetable dye production and application

[Success story of Sodhani Biotech, Jaipur](#)

[Success Story of Hind dyes, Jaipur](#)

[Success Story of Jai Texart, Jaipur](#)

[Success Story of Shipa Guru Gopal Sharma, Jaipur](#)

[Success Story of Sam Vegetable Dyes, Moradabad](#)

Collectively, these success stories illustrate that natural dyes are not limited to niche or experimental use, but can support **economically viable, environmentally responsible, and culturally rooted practices** across multiple sectors.

9.4 Digital Access and Dissemination of the Handbook

Recognising the importance of accessibility and long-term knowledge preservation, this handbook is made available digitally through a dedicated webpage. To reach a broader and more diverse audience, the handbook is published in:

- **English**, and
- **Hindi**

[Digital Hand book on Natural Dyes – English version](#)

[Digital Hand book on Natural Dyes – Hindi version](#)

Digital access allows artisans, students, educators, designers, NGOs, and institutions to engage with the material at their own pace and according to their needs. The online format also supports wider dissemination through sharing links, QR codes, and integration with training programmes.

9.5 Educational Modules and Digital Learning Resources

In addition to the handbook and multimedia content, the project has developed three structured **educational modules** to support deeper learning and institutional engagement. These modules are designed for digital delivery and can be adapted for use in academic, vocational, and community-based learning settings.

The modules include:

1. **Biodiversity Conservation for Artisanal Communities**
2. **Ecosystem Management and Sustainable Harvesting for Natural Dyes**
3. **Circular Economy and Natural Dyes**

Each module connects environmental concepts with practical craft applications, enabling learners to understand the ecological foundations of natural dyeing practices. The modules are intended for use by:

- Colleges and universities
- Skill development and training institutions
- NGOs and community organisations
- Artisan collectives and independent practitioners

Together, these digital learning resources strengthen the project's contribution to climate-responsive education and capacity building, ensuring that knowledge around natural dyes, sustainability, and ecosystem stewardship is integrated into future training and learning frameworks.

9.6 Digital Catalogue of Dye-Yielding Natural Resources

Alongside the handbook, a **digital catalogue of dye-yielding natural resources** has been developed and hosted on our website. This catalogue includes detailed information on plant-based dye sources (native and invasive species) along with their botanical and local names, gps coordinates where these plants are located in Uttarakhand, the part of the plant from which colours are extracted.

The catalogue is available as a **downloadable PDF** and can be accessed via:

[Catalogue of Dye-Yielding Natural Resources – PDF\]](#)

References and Resources

Books, Research Papers and Publications

- *Present Status of Natural Dyes* by Prof. M. L. Gulrajani, Indian Institute of Technology, Delhi.
- *Natural Dyes: Sources, Tradition, Technology and Science* by Cardon, D. Archetype Publications.
- *Natural Dyes and Their Applications to Textiles* by O.P. Agarwal, National Museum, New Delhi.
- *Fundamentals and Practices in Colouration of Textiles* by J.N. Chakraborty, Woodhead Publishing.
- Unexplored treasure of the Garhwal Himalayas Dye yielding plants for Sustainable Dyeing by Nidhi L Sharda and Deepali Rustogi, Dept of Fabric and Apparel Science, Lady Irwin College, Delhi University.
- *Natural Dyes and Pigments: Sustainable Applications and Future Scope* by Arvind Negi, Faculty of Educational Science, University of Helsinki, 00014 Helsinki, Finland
- *The Untapped Potential Of Natural Dyeing Agents: Indigenous Fruits In Sustainable Fabric Dyeing* by Rosalinda B. Velasco, MAIE, Isabela State University – San Mateo Campus, Phillipines
- *Natural Dyes: Chemistry, Applications, and Sustainability* by Dr. S. Shyamkiran Singh, Assistant professor, Dept. of Chemistry, Waikhom Mani Girls' College Thoubal Okram, Manipur.
- *Potential of natural dyes in silk dyeing: Trends, challenges and future prospects* by Nanita Bora, Pooja Borah, Nimiksha Devi, Aditya Das and Savitha Gopalakrishnan, International Journal of Advanced Biochemistry Research 2025.

Contributing Organizations, Experts, and Artisans

The development of this handbook has been enriched through collaboration, field engagement, and knowledge sharing with the following organizations and individuals:

Implementing and Supporting Organizations

- British Council – Support through the *Climate Futures Programme*
- SBMA – NGO who helped to reach out to the artists in Garhwal Himalaya region.
- Tri-Impact Global – Conceptualisation, implementation, research, and documentation

Natural Dye Enterprises and Practitioners

- Sodhani Biotech, Jaipur
- Hind Dyes, Jaipur
- Jai Texart, Jaipur
- HeenaAgrima, Jaipur
- Sam Vegetable Dyes, Moradabad
- Avani – Kumauon
- Himalayan Weavers, Dehradun
- Himal, Bhatwari, Uttarkashi

Artists and Knowledge Holders

- Shilp Guru Gopal Prasad Sharma, Jaipur – mineral-based natural colours in traditional painting
- Mohan Prajapati, Jaipur – miniature artist using mineral-based natural colours
- Badshah, Institute of Natural Dyes, Jaipur
- Tuneshwar Thakur, Madhubani, Bihar
- K.Shiva Reddy. Tangutur, Andhra Pradesh